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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.
The Editor's notes are marked (Ed.).

FIRST PART
ORIGINAL ARTICLES

**The Recent Work at Rothamsted
on the Partial Sterilisation of Soil.**

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Director of the Rothamsted Experiment Station.

The investigations which I propose to describe began in the first instance as the result of an accident. In virtue of its large population, soil absorbs a considerable quantity of oxygen and evolves a corresponding amount of carbon dioxide. An experiment had been arranged to demonstrate the well-known fact that soil heated to 130° C., and therefore completely devoid of micro-organisms, lost much of its power of absorbing oxygen. By an accident, the autoclave was not available and the soil was only heated in a steam oven, and it gave the remarkable result that its power of absorbing oxygen, instead of falling, as was anticipated, considerably increased. Now, the steam oven did not kill all the organisms, but spared those capable of forming spores, i. e. sterilisation was only partial.

Partial sterilisation by means of volatile antiseptics gave the same result. The conclusion was drawn that partial sterilisation increased the bacterial activity, and consequently the amount of decomposition. The increased quantity of plant food thus formed is shown by the amounts taken up by the plant. Table I contains a typical series of results:

TABLE I. — *Weight and Composition of Crops grown on Partially Sterilised Soils.*

	Dry Weight	Percentage Composition of Dry Matter			Weight of Food taken by the Plant from Soil, gms.		
	Grams	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
<i>Buckwheat :</i>							
Untreated Soil . . .	18.14	2.75	1.81	5.62	0.499	0.339	1.019
Soil treated with Carbon Disulphide . .	23.27	3.15	2.34	5.97	0.733	0.544	1.389
<i>Mustard :</i>							
Untreated Soil . . .	15.88	2.30	1.00	4.20	0.367	0.159	0.668
Heated Soil	24.33	4.43	2.08	5.02	1.077	0.506	1.221

This experiment confirmed the earlier results of OBERLIN and others. Further investigations led to the following conclusions:

1. — Partial sterilisation of soil, i.e. heating to a temperature of 60° C. or more, or treatment for a short time with vapours of antiseptics such as toluene, causes first a fall, then a rise in bacterial numbers. The rise sets in soon after the antiseptic has been removed and the soil conditions are once more favourable for bacterial development; it goes on till the numbers considerably exceed those present in the original soil. (Table II).

TABLE II. — *Numbers of Bacteria and Amounts of Ammonia Production in Partially Sterilised Soils.*

	Number of Organisms of Dry Soil in millions, Gelatin Plate Cultures			Ammonia produced in 9 days, in parts per million of dry soil
	At beginning	After 9 days	Increase during 9 days	
Untreated Soil . . .	6.7	9.8	3.1	0.7
Soil heated to 98° .	0.0003	6.3	6.3	3.2
Soil treated with Toluene, which was subsequently evaporated	2.6	40.6	38.0	17.1
Soil treated with Toluene, which was left in	2.3	2.6	0.3	5.5

This confirmed the earlier results of HILTNER and STÖRMER.

2. — Simultaneously there is a marked increase in the rate of accumulation of ammonia. This sets in as soon as the bacterial numbers begin to rise, and the connection between the two quantities is normally so close to indicate a causal relationship; the increased ammonia production is therefore, attributed to the increased numbers of bacteria. There is a disappearance of nitrate: the ammonia is formed from organic nitrogen compounds.

3. — The increase in bacterial numbers is the result of improvement in the soil as a medium for bacterial growth and not an improvement in the bacterial flora. Indeed, the new flora *per se* is less able to attain high numbers than the old. This is shown by the fact that the old flora, when reintroduced into partially sterilised soil, attains higher numbers and effects more decomposition than the new flora. Partially sterilised soil plus 0.5 per cent of untreated soil, or an unfiltered aqueous extract of untreated soil, soon contains higher bacterial numbers per gram and accumulates ammonia at a faster rate than partially sterilised soil alone.

4. — The improvement in the soil brought about by partial sterilisation is permanent, the high bacterial numbers being kept up even after 200 days or more. The improvement, therefore, did not consist in the removal of the products of bacterial activity, because there is much more activity in partially sterilised soil than in untreated soil. Further evidence is afforded by the fact that a second treatment of the soil some months after the first produces little or no effect.

It appears from (3) and (4) that the factor limiting bacterial numbers in ordinary soils is not bacterial, nor is it any product of bacterial activity, nor does it arise spontaneously in soils.

5. — But if some of the untreated soil is introduced into partially sterilised soil, the bacterial numbers, after the initial rise, see (3), begin to fall. The effect is rather variable, but is usually more marked in moist soils that have been well supplied with organic manures: e. g. in dunged soils, greenhouse soils, sewage farm soils, etc. Thus the limiting factor must be reintroduced from untreated soils. (Table III).

6. — Evidence of the action of the limiting factor in untreated soils was obtained by studying the effect of temperature on bacterial numbers. Untreated soils were maintained at 10°, 20°, 30° C., etc., in a well moistened aerated condition, and periodical counts were made of the numbers of bacteria per gram. Rise in temperature rarely caused any increase in bacterial numbers; sometimes it had no action, and often it caused a fall.

But after the soil was partially sterilised the bacterial numbers showed a normal increase with increasing temperatures. Similar results were obtained by varying the amount of moisture but keeping the temperature constant (20° C.). The bacterial numbers in untreated soils behaved erratically, and tended rather to fall than to rise when the conditions were made more favourable to trophic life; on the other hand, in partially sterilised soil the bacterial numbers steadily increased with increasing moisture

TABLE III. — *Effect of Re-infecting Untreated Soil into Partially Sterilised Soil.*

	Gain in Ammonia and Nitrate in 57 days	Number of Bacteria in millions per gram of Dry S		
		After 20 days	After 36 days	After 61 days
Toluened Soil alone.	24.3	28.0	31.8	60.1
Toluened Soil + unsterilised aqueous extract from Untreated Soil . . .	43.7	61.3	45.2	166.6
Toluened Soil + 5% Untreated Soil . .	20.3	32.0	46.9	48.0

content. Again, when untreated soils are stored in the laboratory glass house under varying conditions of temperature and of moisture content the bacterial numbers fluctuate erratically; when partially sterilised soils are thus stored the fluctuations are regular.

7. — When the curves obtained in (6) are examined, it becomes evident that the limiting factor in the untreated soils is not the lack of anything (1) but the presence of something active.

8. — This factor, as already shown, is put out of action by antiseptics and by heating the soil to 60° C., and once out of action it does not reappear. Less drastic methods of treatment put it out for a time, but not permanently: e. g., heating to 50°, rapid drying at 35°, treatment with organic vapour less toxic than toluene (e. g. hexane), incomplete treatment with toluene. In all these cases the rise induced in the bacterial number per gram is less in amount than after toluene treatment, and is not permanent; the factor sets up again. As a general rule, if the nitrifying organisms are killed, the limiting factor is also extinguished; if they are only temporarily suppressed, the factor is also only put out for a time.

9. — The properties of the limiting factor are:

a) It is active and not a lack of something else, see (7).
 b) It is not bacterial, see (3) and (4).
 c) It is extinguished by heat or poisons, and does not reappear if the treatment has sufficed to kill sensitive and non-spore-forming organisms; it may appear, however, if the treatment has not been sufficient to do this.

d) It can be reintroduced into soils from which it has been permanently extinguished by the addition of a little untreated soil.

e) It develops more slowly than bacteria, and for some time shows little or no effect; then it causes a marked reduction in the number

(1) The soils varied from medium loams to rich glasshouse soils well provided with tilting constituents.

f bacteria, and its final effect is out of all proportion to the amount introduced.

f) It is favoured by conditions favourable to trophic life in soil, and finally becomes so active that the bacteria become unduly depressed. This is one of the conditions obtaining in glasshouse "sick soils" (1).

It is difficult to see what agent other than a living organism can fulfil these conditions. Search was therefore made for larger organisms capable of destroying bacteria, and considerable numbers of protozoa were found. The ciliates and amoebae are killed by partial sterilisation. Whenever they are killed, the detrimental factor is found to be put out of action, the bacterial numbers rise and maintain a high level. Whenever the detrimental factor is not put out of action, the protozoa are not killed. To these rules we have found no exception. Further, intermediate effects are obtained when a series of organic liquids of varying degrees of toxicity is used in quantities gradually increasing from small ineffective up to completely effective doses. The detrimental factor is not completely suppressed but sets up again after a time, so that the rise in bacterial numbers is not sustained. But the parallelism with ciliates and amoebae is still preserved: they are completely killed when the detrimental factor is completely put out of action; they are not completely killed, but only suppressed to a greater or less degree, when the detrimental factor is only partly put out of action.

Now this similarity between the properties of the detrimental factor and the protozoa is not proof that the protozoa constitute the limiting factor, but it affords sufficient presumptive evidence to justify further examination. The obvious test of adding cultures of protozoa to partially sterilised soil was made, but no depression in bacterial numbers was obtained; instead there was sometimes a rise. But in view of the history of investigations on malaria and other protozoan diseases no great significance was attached to this early failure.

At this stage the investigation was divided into two parts:

1. — The study of the soil protozoa.
2. — The effects of the limiting factor on the biochemical processes in the soil.

No attempt had ever been made in any of the above experiments to identify the protozoa, or even to ascertain whether any particular form existed in the soil in the trophic state or as cysts. The variety of forms was considerable, and it soon became evident that a definite protozoological survey of the soil was required.

This was accordingly put in hand. In order to give the survey as permanent a value as possible the investigations were not confined to the narrow issue whether soil protozoa do or do not interfere with soil bacteria, but they were put on the broader and safer lines of ascertaining whether a trophic protozoan fauna normally occurs in the soil, and, if

(1) This is dealt with fully in J. Agric. Sc. V (1912), 27-47, 86-111.

so, how the protozoa live, and what is their relation to other soil inhabitants.

The first experiments were made by GOODEY (1) mainly with ciliates, and indicated that these protozoa were present only as cysts. Subsequent investigations, however, by MARTIN and LEWIN established the following conclusions (2):

1. — A protozoan fauna in a trophic state normally occurs in soils.
2. — The trophic fauna found in the soil differs from that developing when soil is inoculated into hay infusions: the forms which appear to predominate in the soil do not predominate in the hay infusions, and vice versa, the forms predominating in the hay infusions do not necessarily figure largely in the soil.

3. — The trophic fauna is most readily demonstrated and is therefore presumably most numerous, in moist soils well supplied with organic manures, e. g. in dunged soils, greenhouses soil, sewage "sick" soils, and especially glasshouse "sick" soils.

Two methods were used for demonstrating the existence of the trophic fauna. The simplest is to place some of the soil in a porcelain dish and cover it with a fixative solution delivered through a funnel, the fixative solution being either picric acid or mercuric chloride dissolved in water till saturation is reached, and then mixed with an equal volume of alcohol. In a short time a film is formed which can be picked up on cover slips and mounted in the usual way: it contains many of the organisms in the form in which they actually existed in the soil. Unfortunately, the method is not completely under control, and sometimes for no apparent reason it fails to work.

The second method is to blow air through a mixture of soil and water contained in a long glass tube (50 cc. long) and allow the bubbles to break against a cover slip coated with agar. Some of the protozoa detach themselves from the soil particles, are caught up in the bubbles, and then adhere to the agar on the slip.

By this method MARTIN and LEWIN found that the dominant forms in a rich cucumber soil were amoebae: one was of the limax type to which they gave the name *Vahlkampfi* soli, one of the lamellipodian type which they called *Amoeba cucumis*, and there were two types of Thecamoebae: *Euglypha* and a *Trinema*. A garden soil of poorer quality contained a more varied fauna, both of amoebae and thecamoebae, but apparently in smaller numbers. Small monads also were numerous.

Finally, the latest experiments by GOODEY have shown that when this trophic fauna is introduced into partially sterilised soils the bacterial numbers are brought down. The earliest attempts to carry out this experiment failed, as already stated, only one successful experiment by CUNNINGHAM being on record. It was not till GOODEY discovered the conditions for successful inoculation that it could be carried out. GOODEY

(1) GOODEY, Roy. Soc. Proc., B. 6 (1914), 417-451.

(2) MARTIN & LEWIN, Phil. Trans., 205 (1914), 77-94; and J. Agric. Sci. 7 (1915), 107-122.

and that mass cultures of protozoa failed when introduced direct from culture medium into partially sterilised soils, but succeeded when introduced through the medium of some untreated soil. In these circumstances the protozoa lived, and numbers of bacteria were reduced. The protozoa used in these investigations were amoebae of the limax type, these being the forms common in the soil.

Thus it was shown that these protozoa lead an active life in the soil, and that one result of their activity is to keep down the numbers of bacteria.

The further problem was put in hand of finding out how numerous are the protozoa in the soil, and how this activity varies with the different conditions obtaining in the field. A dilution method is adopted somewhat similar to that used for enumerating the soil bacteria. The investigation is still only in its early stages, but already it is clear that amoebae and flagellates are present in at least tens of thousands per gram of soil, while ciliates can only be found in hundreds. Some of the organisms appear to be new to science, and many of them are of considerable interest.

The other part of the investigation consists in studying the effects of these detrimental organisms on the process of food production in the soil. For this purpose it is not necessary to find what the detrimental organisms are; it is sufficient to divide the soil organisms into two groups in their relations to the processes of food production; a useful group and a detrimental group. The latter are, more generally speaking, more readily killed than the former. Conditions that are harmful to active life in the soil tend, therefore, to reduce their numbers and lead ultimately to an increased activity of the useful bacteria. On the other hand, conditions favourable to active life tend to keep up the detrimental organisms and therefore to reduce the useful bacterial activity. It is thus possible to account for a number of obscure paradoxical effects that have hitherto caused considerable perplexity. It has already been observed by practical men in various countries that certain soil conditions harmful to the growth of organisms were ultimately beneficial to productiveness, such as long continued and severe frosts, long drought (especially if associated with hot weather), efficient heat, treatment with appropriate dressings of lime, gas lime, carbon disulphide, etc.

Further it has been observed that conditions which are undoubtedly favourable to life, such as the combination of warmth, moisture, and organic manures found in glasshouses, lead to reduced productiveness after a time. This phenomena is spoken of as "sickness" by the practical man.

It is difficult to account for these results on the old view that the useful plant-food making bacteria are the only active microorganisms in the soil. On the other hand, the new view that detrimental organisms are also present readily explains the observed facts.

The "sickness" that affects the soil of glasshouses run at a high pitch (such as cucumber houses), and less slowly at a lower pitch (such as tomato houses), has been investigated in some detail owing to its great tech-

nical importance. It was traced to two causes: an accumulation of various pests, and an abnormal development, especially in cucumber houses, of the factor detrimental to bacteria. The properties of this factor show that it is identical in character with that present in normal soil, and strongly indicate its biological nature. No evidence of a soluble toxin could be obtained. On the other hand, some remarkably interesting protozoa and allied organisms have been picked out from these sick soils and described by MARTIN, LEWIN and GOODEY. Finally, it has been shown that the whole trouble can be cured by partial sterilisation, and methods suitable for large scale work have been investigated and are now in use in practice. Steam heat at present proves most convenient, but the suitability and detailed effects of lime have been studied by HUTCHINSON and M'LENNAN, and of various antiseptics by RUDDIN.

On the technical side the investigation is being developed with a view to the discovery of cheap methods of partial sterilisation. Speaking generally, this type of work is done much better by practical men on their own holdings than at scientific institutions.

It was of course hopeless to try and interest the farmer in any method of partial sterilisation as the cost would be prohibitive, but it was not difficult to interest some of the market gardeners working under glass. Demonstrations made in their nurseries at once appealed to them, and showed that the results were worth having. In consequence of the many modifications they have introduced, the costwork of ing has greatly fallen and partial sterilisation is now extensively practised both as a cure for sick soils and as a method of killing the soil insect and fungoid pests that cause so much havoc in the industry. A special Experiment Station has been set up in the district where the various problems arising out of the industry can be dealt with. One of these is the full investigation of the various methods of partial sterilisation both by chemicals and by heat.

LIST OF PAPERS ON PARTIAL STERILISATION.

- E. J. RUSSELL and H. B. HUTCHINSON. The Effect of Partial Sterilisation of Soil on the Production of Plant Food. (*Journal of Agric. Science*, 1909, Vol. 3, pt. 2).
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SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

398 - **Agricultural Progress in the Province of Quebec, Canada, in 1915-1916.** - *Report of the Minister of Agriculture of the Province of Quebec, 1916, 1 Vol., 1 p. xv + 308. Quebec, 1916.*

The Report of the Minister of Agriculture to the Lieutenant Governor of the Province of Quebec for the year 1915-1916 gives a summary of the work done by the various services, the schools of agriculture and domestic science, and the principal agricultural institutions of the province. It shows the methodical development of the programme mapped out by the Minister of Agriculture 5 years ago, the chief aims of which were to lead the farmer in the way of progress and to give a greater impulse to agriculture.

EDUCATION. - The extent of the progress made may be well appreciated by a consideration of the number of students entered at the 3 principal agricultural schools of the province. The figures for 1915-1916 were as follows :

Macdonald College	470 students
Agricultural School of Ste-Anne-de-la-Pocatière	365 "
Oka Agricultural Institute	175 "
Total	1010 students

Every year new grants are made for the establishment of domestic science courses in convents. Fifty educational institutions now receive such grants and are in a position to give really appropriate instruction to young girls from the country. These courses are very popular. The teachers, both religious and lay, are qualified students of the domestic science schools of Montreal, St. Pascal, Roberval and Sutton. Five

to 1916, 121 women teachers followed the vocational normal course at the Provincial Domestic Science School and 83 religious women teachers at 6 different congregations were enabled to follow the course of the 3 other schools.

Thanks to a special grant, the convents of Montebello, Ste-Marie de Beauce, Trois-Pistoles, Frazerville and Drummondville have given summer courses comprising theory and practice, to the people of the district. These courses, of 5 days' duration, were enthusiastically followed, not only by women of the middle and working classes, but also by those of the higher classes. The average daily attendance was over 100. The interest taken in the exhibits of works of all kinds at the Quebec Exhibition clearly proves that the good effects of this instruction are being seriously felt. The chief purpose aimed at is to revive amongst the farmers those domestic industries which formerly brought them good profit and occupied their leisure during the long Canadian winter.

COÖPERATION. — The number of cooperative societies organised during the fiscal year was 21, bringing their total up to 162. The amount of business done by the Quebec Cheesemakers' Cooperative Agricultural Society and the Comptoir Coopératif de Montréal, the two principal central cooperative Societies, the former for sales, the latter for purchases, in the year 1916, amounted to \$ 3 000 000 and \$ 150 000 respectively. A group of 25 cooperative societies have formed a federation under the direction of the Abbé Allaire. They are chiefly concerned with sales, and ship their products to the Montréal market. The profits accumulated by the Cooperative Agricultural Society of Yamaska Valley enabled it to pass through the difficulties arising from a poor tobacco crop. The Abattoir School of St. Valier, whilst still preserving its character of a school, is now managed by the Cheesemakers' Cooperative Society, and it is probable that the Cooperative Abattoir at Princeville will also lease its establishment to this Society for a certain number of years. The pupils of the Oka Agricultural Institute have organised a cooperative society that keeps a store for all the articles they require; this will enable them to study in a practical manner the working of cooperative societies.

DAIRY INDUSTRY. — The number of factories at present in the province is 1 991, of which 883 are cheese, 585 butter and 523 combined factories. During the year the production of butter and cheese in these factories amounted to \$ 21 000 000, as opposed to \$ 18 400 000 in the previous year. In 1910, the cream and milk exported amounted to \$ 150 792; they have now reached a figure of \$ 1 455 405. On the London market the sterilised butter exported by the Quebec Cheesemakers' Cooperative Society was considered as the finest lot of butter received from Canada.

STOCK-BREEDING. — Premiums are distributed to 85 agricultural societies and 710 farmers' clubs, and loans, without interest, are made for the purchase of pure-bred breeding stock. The premiums thus distributed last year amounted to \$ 38 102 50, and the loans to \$ 10 196 44. The four principal agricultural exhibitions that form what is called the St.

Lawrence Valley Circuit: Quebec, Sherbrooke, Three Rivers and Valley field, receive a yearly total grant of \$ 30 000. Over 60 agricultural associations hold county exhibitions. The legislature passed a new law last year to give sheep breeders more protection against dogs, and it is hoped that this will help to increase the number of sheep in the province. Notwithstanding the decrease that has been felt for the last 15 years, the province of Quebec occupies the second place among all the provinces with an average of 4 sheep per farm.

HORTICULTURE. — This branch, of which the staff is composed of 17 experts, is devoted particularly to promoting the progress of arboriculture, horticulture, floriculture, and the industries derived therefrom: 1) by establishing and superintending demonstration fields or stations intended to popularise the employment of the best methods of cultivation; 2) by giving to private initiative the support or direction which it needs by practical demonstrations, lectures or publications; 3) by organising horticultural societies and making them benefit by exceptionally advantageous offers with the view to inciting the producers to associate, develop the industrial activity of the members and prepare the way for cooperation.

POULTRY-KEEPING. — There are 25 poultry-raising stations, which with the aid of Branch instructors, spread proper methods of poultry raising. In addition, grants have been made for teaching poultry raising to country school children. Pure-bred eggs are distributed among them, and they are given practical lessons relating to poultry-keeping and the cultivation of vegetables and forage capable of feeding poultry economically. The export of eggs, which had been abandoned owing to the extraordinary increase in consumption has, for some time past, revived in an encouraging manner, in spite of the continual rise in prices.

API CULTURE. — In 1915-1916 the 7 apiary inspectors made 2 177 visits. The Italianisation of the beehives was encouraged by the distribution of 1 000 Italian queens in 195 beehives at 55 cents each, i. e. a half purchase price. In the 40 counties the bees made 2 561 977 lbs. of honey; this represents a value of \$ 291 050 80.

AGRONOMISTS. — There are 12 agronomists, of whom 6 have assistants. As soon as the finances of the province and the number of agricultural experts allow it, it is hoped to establish agricultural bureaux in all the agricultural counties.

The total money spent by the Department of Agriculture during the fiscal years was \$ 725 747 96.

The policy of "Return to the Land" commended by the Government is strongly seconded by all the educational institutions. The education based on agriculture which is given to the children has created a current of new ideas in agriculture and attracted towards it the attention of all classes of the population.

Agriculture in Fiji. — *Colonial Annual Reports, Fiji, No. 887, Report for 1915.* London, August, 1916.

The following figures presented in the last Report of the acting Governor Fiji do not include native cultivation and so far as Europeans are concerned, can only be taken as estimates, owing to the disinclination of some of the planters to furnish particulars of their cultivation.

Sugar. — The number of acres under sugar cane in 1915 was 62 308 against 62 852 in 1914 and the number of tons of cane produced was 883 in 1915 as against 874 164 in 1914.

Coconuts. — The area under coconuts cultivated by Europeans was estimated at 45 102 acres in 1915 as against 42 492 acres in 1914. The cultivation of coconuts continues to grow notwithstanding extraordinary conditions which, during the year, have unsettled and restricted the copra market. The experiments at Lancela being conducted by the Department of Agriculture with a view to improving the condition of coconut trees on Viti Levu were continued throughout the year. A decided benefit has followed cultivation of the trees and the application of manures. It has been attempted to extend these experiments by planting plots of trees at various places on the coast and carefully selected seed nuts have been collected and distributed.

Bananas. — The area under bananas cultivated by Europeans was estimated at 5 782 acres as against 666 7 acres in 1914, and the prices obtained for bananas during the year were most satisfactory.

Pineapples, mandarines and kumalas. — During the year 1 225 cases of apples, 3 159 cases of mandarines and 185 sacks and 30 cases of kumalas, sweet-potato of Fiji, were shipped to Australia and New-Zealand.

Cotton. — As in previous years, cotton produced by planters to whom it had been supplied, was purchased and ginned by the Agricultural Department for ultimate delivery and sale to the British Cotton Growing Association. At the experimental stations cotton was the chief crop. It was originally intended to continue experiments in the cultivation of cotton for a period of ten years. Nine years have now been completed and the results from an agricultural point of view are to be considered as satisfactory.

Rubber. — Rubber to the value of £ 3 464 was exported in 1915 as against £ 13 during the previous year. It is hoped that the exports of this product will increase.

Land grants. — The total amount of land alienated in 1915 was 654 022 acres comprising crown and native grants and crown and native leasehold. The area held by the crown open to settlement amounts to 92 499 acres. The unalienated land including land occupied by Fijians amounts to 1 879 acres in extent, the total area of the Colony being 4 758 400 acres. In addition to these native leaseholds referred to above, 439 leases for 4 acres were surveyed during 1915, but the leases remained unregistered. The 690 leases for 11 964 acres have been approved but have not yet been surveyed.

The number of applications to lease land received in 1915 was the

greatest yet recorded, but the area was less than in 1914, which is probably due to a falling off in the number of applications received from Europeans.

Regulations were made by the Governor in Council on the 26th Jan 1915, prescribing the conditions on which consent is granted for leases of crown and native lands.

400 - Swine as Agents in the Spreading of Sleeping Sickness in the Valley of Inkisi Central Belgian Congo, (1). — GREGG, G., in *Bulletin de la Société de Pathologie exotique* Vol. X, No. 2, pp. 113-117; February 14, 1917.

From May to November 1914, 94 pigs from the Inkisi Valley district were examined at the market of Kisantu. Thirty-six of these pigs (38%) were found to be suffering from trypanosomiasis (*Trypanosoma congolense*). High as this percentage is, it must be considered below the actual figure because as trypanosomes occur only in very small numbers in the blood of pigs, an examination of the blood of infected animals, unless repeated many times, does not always reveal their presence. The whole of the Inkisi Valley has become infected, from the railway bridge (163 miles) to the Portuguese Congo.

From an economic point of view swine trypanosomiasis causes no harm to the owners, as animals attacked by it breed normally, show no outward signs of disease and may be in very good condition.

There is no direct correlation between human trypanosomiasis (sleeping sickness) and that of the pig; in the same district, the one may be very widespread, the other almost absent. In the Kisanthu district in 1915, 7 per cent of the natives suffered from the disease, whereas 32 per cent of the swine were attacked. Indirectly, however, the districts where pig-breeding is increasing, are threatened with grave risks of infection. Herds of pigs are an easy and continual source of food for *Glossina* and act both as breeding centres and carriers. One person only suffering from sleeping sickness in a village is a constant source of infection for others. The Tumba Ma district, for example, offers ideal natural conditions for resisting this disease yet, as a result of extended pig-breeding, it was invaded and ravaged by the sickness.

The natives make a considerable profit from pig-breeding which, since the animals are left free to wander round and find their own food, cost nothing. It seems impossible, under these circumstances, to stop pig-breeding, or even to restrict it to certain given areas in each village. The only method of checking the disease seems, therefore, to be the systematic examination of the population for human trypanosomiasis.

401 - Destruction of Mosquito Larvae in Rice Fields by Carp, an Effective Means against Malaria. — See No. 472 of this Bulletin.

(1) See also B., March, 1917, No. 216

Agricultural Instruction in Canada (1). — JAMES, C. C. in *Sixth Annual Report of the Commission of Conservation (Committee on Lands)* pp. 1-15. Ottawa, 1915.

On the advice of the HON. MARTIN BURRELL, minister of Agriculture, Dominion Government, in 1913, appropriated \$ 10 000 000 to be expended on agricultural instruction during a period of 10 years. For the first year, 1913-1914, \$ 700 000 was set aside — for 1914-1915, \$ 800 000 — 1915-1916, \$ 900 000, so that in 1917 the maximum of \$ 1 100 000 will be reached unless the Government should think well to add to that amount.

Purpose of Appropriation. — This money is set aside for the purposes of education instruction and demonstration. As under the "British North America Act" education is a prerogative of the provinces, and the Dominion Government is not supposed to interfere in the matter, this money is handed over to the various provinces to be expended through their Departments of Agriculture and Education. The Dominion Department of Agriculture confines itself to aiding in an advisory capacity and to supervising the work.

Basis of Division. — The basis of division among the provinces was as follows: First of all \$ 20 000 a year were set aside for 2 veterinary colleges; one in Toronto, affiliated with the University of Toronto, and one in Montreal, affiliated with Laval University, for these colleges provide instruction for all the provinces alike.

Each province has received \$ 20 000 irrespective of population, area, or natural production.

Agricultural Education in Prince Edward Island. — Prior to 1912, this island had practically no agricultural organization. All the agricultural extension work was done by the Dominion Department of Agriculture. Thanks to new funds, it has been possible to institute a definite course in agriculture (including live-stock, field crops and dairying etc.) at Prince of Georges College. An annual exhibition has been organized at Charlottetown, where a hall has been built in which agricultural lectures can be held. At present time, 200 or 300 students and farmers are receiving instruction on various lines. Three departmental officers have been placed in charge of the 3 counties, and Womens' Institutes have also been organized. Teaching of nature study and agriculture has been undertaken in the public schools. The Secretary for Agriculture is now assisted by a permanent staff of 5 members. The budget for 1917 will amount to \$ 31 754.

Progress in Agriculture in Nova Scotia. — The Provincial Secretary for Agriculture is also the Principal of the Agricultural College at Truro, so that the agricultural life of Nova Scotia is centred at Truro, and not at Halifax. In the former town, there is a normal school, an Agricultural College and the headquarters of all the provincial agricultural officials. Attached to the staff of the normal school there is a Director of Rural Education, he instructs the teachers-in-training in agricultural and nature study

¹ See also B. 1914 pp. 655-662. Original Article by Prof. S. B. MACCREADY — "The Condition of Agricultural Education in Canada", and No. 398 of this *Bulletin* (Ed.)

and has a general supervision of work throughout the province. By raising the salaries of the instructors engaged in this new work, the rural schools have been able to retain able men who were before attracted by pecuniary advantages to other provinces. Five permanent offices of instruction have been created in this Province and the Womens' Institute movement has been encouraged, and is now carried on with funds from the Federal grant. The latter in 1917 will amount to \$ 81 719.

Agricultural Progress in New Brunswick. — As a result of an arrangement made with the executor of the "Fisher Estate", the "Fisher Vocational School" was erected at Woodstock. This school is equipped for teaching agricultural, manual training and domestic science. A second school has been founded at Sussex; a third in the northern portion of the province is in prospect, while a fourth will perhaps be built at Fredericton. Rural education is under the direction of an Inspector who is carrying on enthusiastically the work of introducing agriculture into the rural schools of the province. In addition, the salaries of 13 instructors directing all the agricultural instruction in the province are paid out of the Federal grant. The Womens' Institutes also have been encouraged and they are growing in numbers and extending their sphere of usefulness. The Federal grant in 1917 will amount to \$ 64 118.

Agricultural Education in Quebec. — In this province, there are 3 agricultural schools: the Oka Agricultural Institute on the Trappist Estate at Lake of Two Mountains; the School of Ste-Anne-de-la-Pocatière in Kamouraska County, below Quebec, and Macdonald College, near Montreal.

The school at Ste. Anne is the oldest agricultural school on the American continent. It is being enlarged, as is also the Oka Agricultural Institute, and the new buildings will double the accommodation now existing. The sum of \$ 5 000 a year is being taken for the 10 years of the Act to pay the cost of these buildings. The Oka Institute has secured the collaboration of PROF. HANSEN of Copenhagen, PROF. WATCH of Geneva, and PROF. NAGANT of Louvain. At Macdonald College 8 additional instructors have been appointed, chiefly to carry on the extension work. Many other lines have been inaugurated and extended by the Provincial Department — fruit culture — dairying — tobacco-growing — bee-keeping — drainage and domestic science. Further, 27 offices have been created in Quebec, and 27 permanent instructors appointed; in addition to these, there were many temporary assistants during the summer. The grant in 1917 will amount to \$ 271 068.

Agricultural Instruction in Ontario. — Ontario has more lines of agricultural work organised than any other province, therefore the Federal grant has been mainly employed in extending, or enlarging, the organisation already in operation, by appointing new agricultural instructors. In all, 49 have so far been appointed. There have been created a department of co-operation and marketing and also a department of vegetable-growing. The 20 new offices that have been created by the help of the Federal grant each have an instructor and an assistant, which allows of the work of instruction being carried direct to the farmers on their own farms. The agricul-

tural College at Guelph now possesses the finest field husbandry building on the American Continent. A great impetus has been given to plot-growing work done by boys and girls on the farm, the products being exhibited at fairs held in the schools. The pupils show great enthusiasm for these competitions which have been extended to stable, poultry and dairy produce, and are spreading rapidly throughout all the provinces of Canada.

At the Guelph Agricultural College, 65 farmers' sons are given a two weeks' free course, as a prize for growing potatoes in acre plots in their own county or district. The boys' expenses to that college are paid out of the Federal grant. This grant in 1917 will be brought up to \$ 336 319, and a portion of this will be devoted to the extension of agricultural instruction in rural schools. In 1915, the sum thus added to the grant of the Provincial Department of Education was \$ 30 000.

Agricultural Education in Manitoba. — The Manitoba Department of Agriculture handles all the Federal grant (which will amount in 1917 to \$77 144) itself, and none of it goes to the Agricultural College, or the Education Department for teaching agriculture in the public schools. The Department has for some time carried on the work of teaching nature study and agriculture in schools under Mr. J. H. WATSON. The Provincial Department spends most of the money obtained from the Federal grant in demonstration farms and demonstration trains. Their purpose is to organise these demonstration farms all over Manitoba with the view of discouraging the practice of growing wheat only, and in the hope of promoting mixed farming (stock-breeding and crop-growing).

Methods applied in Saskatchewan. — This province divides the grant it receives (which will be \$81 733 in 1917) equally between the Faculty of Agriculture of the University of Saskatchewan, and the Department of Agriculture. The University of Saskatchewan has thus been enabled to appoint 13 additional professors and instructors, mainly for the purpose of extension work. In addition, 8 provincial instructors attached to the Agricultural Department have been appointed. The province is about to appoint a director of rural education and 1 or 2 directors of domestic science.

Agricultural Instruction in the Province of Alberta. — This province possesses 6 demonstration farms and it was decided to attach an agricultural school to 3 of them. On account of the excellent work done by these schools, the Canadian Pacific Railway Co. intend to give them some substantial assistance. There are 15 instructors in agriculture provided for out of the Federal grant, and the Province hopes to increase the number. The grant will reach \$66 971 in 1917.

Agricultural Instruction in British Columbia. — The Provincial Department has been using its Federal Grant mostly for field competitions and for boys' and girls' competitions (in cultivating small plots). The sum of \$15 000 has recently been set apart for agricultural instruction in the public schools under the direction of Mr. J. W. GIBSON. Nine other agricultural instructors have been appointed.

The Federal grant to British Columbia will amount to \$ 69 202 in 1917.

In short, the Federal grants have furnished to the different provinces about \$ 250 000 for buildings and equipment for agricultural instruction and they have provided for 155 permanent instructors in the different provinces who have organized or extended practical agricultural teaching in all the provinces of Canada.

- 403 - **Separation and Identification of Food Colouring Substances.** — MATTHEWSON, W. E. in *United States Department of Agriculture, Bulletin No. 448*, 56 pp. Washington, February 15, 1917.

The scheme of analysis of dyes described in this bulletin embraces about 130 distinct chemical compounds. This number comprises practically all those coal-tar colours (except a few entirely obsolete nitro dyes) which have been mentioned in the literature as having been found in food products and those stated by chemists to be suitable for the colouring of foods.

The scheme of separation described in the above-mentioned bulletin is designed to meet actual conditions, one of which is the relatively more frequent occurrence of the 8 colours which the United States Department of Agriculture permits to be used in food (Food Inspection Decisions, Nos. 76 and 164) — Amaranth Ponceau 3 R, Erythrosin, Orange I, Naphtho yellow S., Tartrazin, Light green, S. F. yellowish, and indigo disulphoacid. The separation method is mainly based upon the employment of immiscible solvents.

CROPS AND CULTIVATION.

- 404 - **New Experiments on Soil Sterilisation in France.** — MITON, M., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 164, No. 9, pp. 362-365. Paris, February 26, 1917.

Since 1914, the writer has made new experiments with regard to the fertilising influence and antiseptic value of the sterilisation of soils (1). Great attention should be given to the study of this subject, not only in view of the increased yields which may be expected, but also because the sterilisation of the soil greatly decreases the large losses suffered annually from the attacks of epiphytic parasites.

Two sets of experiments were carried out; the first in open fields and in gardens on: potatoes, buckwheat, beans, tomatoes, carrots, leeks; the second under glass and in the open, chiefly on tomatoes, but also on cucumbers and carnations.

The following antiseptics were used during the last two years: - toluene-formol - lysol - shale oils - wood charcoal - potassium permanganate - hydrogen peroxide - calcium hypochlorite - sulphur - sulphides, etc. Most of these were applied before sowing, a few were applied only after sprouting, whereas others were used in the preparation of vegetable mould or composts.

(1) See also: *The Partial Sterilisation of Soil*, by E. J. RUSSELL, pp. 673-681 of this Bulletin.

FIRST SERIES OF EXPERIMENTS. — The following results were obtained in clayey loam plots measuring 20 square metres each :

TABLE I. — *Yields (in Kilograms) obtained in the 1st series of experiments.*

Antiseptic Used	Beans	Tomatoes	Carrots	Potatoes	Buckwheat (green)
Toluene	—	—	37.100	13.760	45
Carbon bisulphide	—	—		12.880	44
Hydrogen peroxide	—	—		12.720	—
Lysol	—	—	42.500	—	—
Formol	—	—		12.740	43
Potassium permanganate	0.950	—		13.020	—
Copper sulphate	—	—	—	14.120	—
Sulphur	—	—	—	16.920	43
Calcium hypochlorite	1.250	50.500	—	—	46
Wood charcoal	0.900	—	—	12.720	—
Controls	0.550	25.000	14.165	8.440	40

The antiseptics had a marked effect, and their application was accompanied, not only by a notable increase in yield, but also by an undeniable decrease in disease and other injuries of the plants treated.

SECOND SERIES OF EXPERIMENTS. — These trials all gave similar results. They were carried out on more than 600 square metres of cultures under glass and more than 1 hectare in the open. These experiments were therefore no longer on a laboratory scale, and as the land was used for commercial purposes to a certain extent, it was necessary that immediate profits be realised.

In these tests, as in the previous ones, the yield was considerably increased and the treatment had a distinctly beneficial effect on the health of the plants. The land and glass-houses used had been devoted to the cultivation of early tomatoes for 15 years. It is obvious that continual intensive cultivation in the same warm and damp surroundings would make the vegetables particularly subject to all diseases, and indeed, in spite of the greatest care and attention, the plants were so infested with parasites, that growth was very seriously compromised and successful cultivation very uncertain. In this case, therefore, peculiar interest was attached to the sterilisation of the soil.

The variety of plant used was more especially the "Joffre", a type with firm, smooth fruit. The control plots were between the experimental plots, and all were submitted to identical conditions of development. Table II gives the results per glass-house and per hectare (each glass-house had an area of 400 square metres and contained 1600 plants).

TABLE II. — *Yield per Glasshouse and per hectare.*

No. of glasshouse	Antiseptic used	Amount used (kilograms)		Yield obtained (kilograms)		
		per glasshouse	per hectare	per glasshouse	per plant	per hectare
1	Toluene	12	300	3 300	2.062	82 500
	Wood charcoal	30	750			
	Carbon bisulphide	10	250			
2	Wood charcoal	30	750	3 040	1.900	70 000
3*	Lysol (1st. month)	1 per cubic metre	—	2 200	1.375	55 000
	Formol (2nd month)	1 " " "	—			
	Toluene (2nd month)	1 " " "	—			
4	Wood charcoal (1st month)	10 " " "	—	2 400	1.500	58 000
5	Lysol	5 at 5:1000	125	2 200	1.375	55 000
6	Calcium hypochlorite	64	1 500	2 500	1.562	62 500
7	Calcium hypochlorite	64	1 500	2 550	1.570	63 750
8**	Copper sulphate	10	250	2 100	1.312	52 500
	Wood charcoal	20	500			
9	Hydrogen peroxide	500 litres at 10:1000	125	2 200	1.375	55 000
	Sulphur	10	250			
10	Calcium hypochlorite	500 litres at 10:1000	125	3 000	1.875	75 000
	Wood charcoal	25	625			
11	Potassium permanganate	600 litres at 5:1000	75	2 450	1.530	61 250
12	Formol	10 litres at 7:1000 per cubic metre	—	2 350	1.470	50 750
13	Sublimated sulphur	20	500	2 150	1.345	53 750
	Wood charcoal	25	625			
14	Naphtol B	5	125	2 800	1.750	70 000
15	Open air	—	—	2 800	1.750	70 000

* In Composts (pot cultures). — ** Mixed.

The highest yield was 3 300 kg. per greenhouse, or more than 2 kg. of fruit per plant and 82 500 kg. per ha. These amounts were obtained with toluene or carbon bisulphide. The lowest yields, obtained from copper sulphate, exceeded 2 100 kg. per glasshouse, that is to say they gave an average of 1.31 kg. per plant and 52 000 kg per ha.

If these results are compared with those obtained the same year at Rennes the following conclusions may be drawn :

1) Soil sterilisation carried out under varied conditions (in the open, in glasshouses, in different soils) for different vegetables has been shown to

exert a definite favourable influence on the yield as well as on the health and value of the products.

2) To a certain extent this action is specific as regards the nature of the chemical substances used and that of the plants treated with them. For example, toluene, then carbon bisulphide, give the best results for the same plant under the same conditions (Paramé tomatoes, under glass), whereas elsewhere, and on other cultures, hypochlorite, sulphur, etc., were found to have the most active and favourable effect.

These results fully confirm those already obtained by the writer (1), as well as those obtained abroad and give further proof of the beneficial action of the antiseptic treatment of soils.

405 - **The Use of Iron in Agriculture.** — MONNIER, A. and KUCZYASKI, L., (Compte rendu de la séance du 5 Octobre 1916 de la Société de Physique et d'Histoire naturelle de Genève) in *Archives des Sciences physiques et naturelles*, Year 122, Vol. XLIII, No. 1, pp. 66-68. Geneva, January, 15, 1917.

Up to the present it has been found impossible to make any positive statement with regard to the use of ferruginous manures on account of the discrepancies in the results obtained. Some years ago the writers, in collaboration with Professor CHODAT found that a very dilute solution of a ferric salt has a marked effect when applied at the beginning of vegetation, whereas, if applied when the plants have already reached a certain stage of development, it has practically no effect. Where favourable results were obtained an increase in the iron content of the plant ash corresponded to an increase in growth. As the soil was naturally rich in ferric oxide it may be assumed that the iron normally in the soil is present in a form difficult to assimilate. In order to explain these divergences, the writers carried out experiments to determine: 1) the degree of solubility of the iron already in the soil; and 2) the changes undergone by ferrous and ferric compounds in arable land.

Soils of normal composition show no trace of iron when washed with pure water or dilute solutions of alkaline carbonates and bicarbonates. The

(1) Cf. MIÈGE, EM., "New theories on the fertilisation of soils", in *Comptes Rendus de la Société nationale d'agriculture de France*, March, 1914.

In 1912 and 1913, the writer organised at the National School of Agriculture at Rennes, two sets of experiments, one in bottomless boxes placed in the earth and filled with sandy loam, the other in fields of clayey loam. The plants used were white mustard and two rowed barley. The antiseptics included: - toluene, carbon bisulphide, formaline, chloroform, tar, creosote, acetone, naphthol, carbolic acid, mercuric chloride, copper sulphate, baryta, potassium permanganate.

In the case of *white mustard* the highest yields were obtained with toluene, then with carbon bisulphide; formaline (very small quantities) and tar came next. Baryta, naphthol and creosote were distinctly harmful. Copper sulphate had a deleterious effect in the artificial soil, but a favourable one in the fields. Permanganate proved very active.

Barley gave very similar results; toluene came first, then in order: - carbon bisulphide, formal, chloroform, tar, weak solutions of carbolic acid. Potassium permanganate was also very active.

following experiments were carried out on soil containing 3.2 % of iron and 6 % of lime :

- 1 % *Acetic Acid* : Nothing dissolved.
- 5 % *Acetic Acid* : The solution contains traces of iron.
- 1 % *Citric Acid* : The solution distinctly gives the reaction for iron
- 1 % *Tartaric Acid* : " " " " "
- 1 % *Oxalic Acid* : The solution gives a strong reaction. "

100 grammes of soil gave 0.02 grammes of iron when treated with the citric solution and 0.06 grammes of iron when treated with the oxalic solution.

Certain silicious soils entirely lacking in lime, as, for example, the soil of Angers, give a fairly large proportion of iron soluble in pure water. In these soils, pink hydrangeas give blue flowers, but, if a small quantity of calcium carbonate or magnesia is mixed with the soil it no longer gives up any iron and the hydrangeas do not become blue. The compounds of soluble iron are, therefore, precipitated by the lime.

A $\frac{1}{1000}$ solution of ferric chloride was filtered through a layer of soil 20 cm. thick. All the iron was retained in the upper part which turned red-brown. Calcium carbonate precipitates the iron in the form of a basic carbonate which gradually becomes a hydrate. The line of separation is clearly marked, and the filtered liquid contains no iron, but a large proportion of chlorine and calcium. This experiment was repeated with many samples of soil containing different quantities of lime. The coloured layer increases in thickness in proportion as the lime content of the soil decreases. The thickness of the coloured layer does not exceed 2 cm. in soil containing 5 % of calcium carbonate. If ferrous sulphate is used instead of ferric chloride the salt is oxidised and precipitated, and a mixture of basic sulphate and hydrate is formed which colours the superficial layer red-brown, as in the case of ferric chloride.

The results of these experiments show that the iron contained in soils of normal composition is present in a form very difficult to assimilate, which explains the increased yield when very small amounts of soluble iron are added.

The manure can have no favourable effect unless it is placed directly within reach of the roots. This condition is found in pot cultures, or when the manure is added at the beginning of growth, but it is no longer present when the roots have entered the soil to a certain depth, where they receive no trace of the ferric manure, which has been held up and made insoluble in the surface layers of the soil.

Tests were also made with potassium ferrocyanide as a source of iron. The results showed that the compound is not rendered insoluble in the soil, but that certain interesting modifications occur. The salt undergoes a double decomposition, part of the potassium being retained by the soil. When the solution filters through the soil it turns greenish. This is due to the transformation of the ferrocyanide into ferricyanide. This oxidation appears to be due to some surface action, as it also occurs when the solution is filtered through fine sand.

Experiments with potassium ferrocyanide did not give good results as, even in dilute solutions, the salt has a harmful action on vegetation.

406 - *Researches on the Calcium Compounds in Soils in the United States.* — SMOKEY, EDMUND, C., FRY, WILLIAM, H., and HAZEN, WILLIAM, in *Journal of Agricultural Research*, Vol. VIII, No. 3, pp. 57-77. Washington D. C., January 15, 1917.

This work was executed by the Bureau of Soils of the United States Department of Agriculture. The present methods of analysis give the composition of a soil by determining the amounts of each of the elements present; it is, however, very important to know, in addition, the form in which they are found combined. The article analysed is a first step in this direction as regards calcium.

The writers examined 63 soil samples representing 23 soil types from 24 localities in 19 States of N. America.

All the samples were analysed chemically and examined petrographically, the results of the two methods of investigation being correlated, as far as possible. The data are given in two series of tables; the results are discussed, and the following summary made:

From the results of the analyses of the 63 soil samples were calculated the amounts present of: calcium carbonate — calcium sulphate — calcium with humus — the calcium in the form of easily decomposable silicates — the calcium in the form of difficultly decomposable silicates. The figures obtained show a wide variation in the total calcium content — in the calcium carbonate and the two classes of silicates. Calcium combined with humus was shown to be absent in 29 samples.

No relation is apparent between the total calcium content and the quantity of any of the classes of calcium compounds discussed.

It is possible to have two soils with the same calcium content, but with the kinds of calcium compounds present in quite different amounts.

Only 5 of the samples, representing 2 types, were acid to litmus. These types are characterised by poor drainage.

A type represented in the series of samples examined, and recognised as a good alfalfa soil, is characterised by a high calcium content, but is low in content of calcium carbonate.

407 - *Drainage by Dynamite in the United States* (1), — *The South American Journal and Brazil and River Plate Mail*, Vol. LXXXII, No. 9, p. 181. London, February 24, 1917.

An interesting and practical demonstration of the value of dynamite in drainage operations was shown by MR. GRANT KELSEY, a large potato-grower in the United States, at Kiro, Kansas, during the summer of 1915. Fearing that his potato crop would suffer from the excessive amount of surface water due to the persistent rains, especially in a badly drained corner of the field, he determined, as a last resort, to drain off the water by the help of dynamite.

With a post auger, he bored 8 holes at equal intervals through the

(1) For information on the use of dynamite in preparing ground, see *B.*, 1913 No. 230. (Ed.)

field, ranging from 8 to 12 ft. in depth. In these were placed charges of dynamite carrying from 2 to 5 sticks per hole. The larger charges proved the more effective. Each charge formed channels of varying dimensions, according to the amount of dynamite used, and through these the surface water was rapidly drained into the sandy subsoil. The growing crop had suffered no harm from the stagnant water, and the effect of the drainage lasted through the following spring (1916). The holes formed by the explosions resembled small craters, and the rain water passed through them as readily as through a drain-pipe.

408 - **Irrigation Results Obtained in 1916 at the Horticultural Experiment Station of the Province of Ontario, Canada.** - PALMER, E. F., in *Dominion of Canada, Department of Agriculture, The Agricultural Gazette of Canada*, Vol. 4, No. 2, pp. 125-127. Ottawa, February, 1917.

At the Ontario Horticultural Experiment Station, Vineland, in 1916, increased yields of vegetables and raspberries were secured by the use of the SKINNER irrigation system. The irrigated section comprises slightly over 3 acres. The pipes are 50 ft. apart, they rest on metal supports at a suitable height above the ground, and have nozzles every 4 ft. The water supply is secured from Lake Ontario by a gasoline engine. This system gives entire satisfaction. In 7 hours, $1\frac{1}{2}$ acres can be watered at a maximum cost of \$ 3.60 per acre, an acre inch of water being supplied.

Much of the value of irrigation depends on the type of soil. A loose, open soil with an open subsoil is the ideal soil for irrigation. A heavy, compact, clay soil will not respond unless cultivation is greatly increased. The soil on the station irrigation block is variable in composition, ranging from a moderate, sandy loam to a heavy clay.

Strawberries and asparagus occupy the lighter soils, raspberries and vegetables the heavier soils.

The whole plot is well manured and cultivated and treated as uniformly as possible, so that the difference due to irrigation will be correctly interpreted.

Water is applied during dry weather, once every week or ten days, about an inch at a time, depending on the rainfall registered since the last irrigation. Calm days are preferred. Bright sunshine while the water is applied does not cause any apparent injury in this district, though dull days or late evening are desirable when applying the water.

Increased yield per acre due to irrigation :

Raspberries	1136.3	qts.
Asparagus	2078	lbs.
Onions	77.9	bus.
Beetroots	40	bus.
Carrots	72.3	bus.

The writer draws attention to the fact that the economic results were highly satisfactory. The amount of water applied during July was 2.9 inches at the cost (at the Experiment Station) of \$ 10.44 per acre. The to-

total rainfall during this time amounted to 10.1 inches. During a normal, or a drier season, more irrigating would have to be done, but the increased yield would be proportionately higher.

400 - "**Matkee**" (*Aeschynomene indica* L.), a Green Manuring Plant of Tea Estates in India. — AMOLACK RAM, in *The Agricultural Journal of India*, Vol. XII, Part I, pp. 161-162. Calcutta, January, 1917.

A common weed found in jungles, tea gardens, and rice fields, etc., locally known as "matkee" (*Aeschynomene indica* L.) has been found to be very useful for green-manuring in the Palampur valley.

It is an annual leguminous weed, having a round stem of erect or creeping habit, stipulate compound leaves attached to the stem with a short stalk; bisexual flowers of yellow colour; the calyx is composed of five sepals, the corolla having five petals; stamens are ten in number.

Points in favour of the use of "matkee" for green manuring of tea estates.

a) It is a leguminous plant and will fix nitrogen in the soil; b) it is of rapid growth; c) it checks the growth of other weeds and grasses which hinder the growth of tea bushes; d) it does not in any way hinder the leaf-producing power of the tea plant in its growing season; e) it uses the plant food which is usually washed away during rains and restores it to the field when the crop is ploughed in; f) being a common weed it grows well without any trouble.

Seeds should be sown in the end of May and the crop buried in August, when the plant is in flower.

410 - **Plants Used as Green Manure for Tobacco, in Java.** — See No. 446 of this Bulletin.

411 - "**Germaniaphosphat**", a New German Phosphatic and Potassic Manure. — BEGER, C. (Hohenheim Experimental Station), in *Fühlings Landwirtschaftliche Zeitung*, Year 66, Part 2, pp. 55-58. Stuttgart, Jan. 15, 1917.

As basic slag and superphosphates are very rare and very expensive in Germany, attempts are being made to replace them by other phosphatic manures, as, for example, "Rhenaniaphosphat" (already described in B 1016, No. 496).

The "GERMANIA" factory of Portland cement at Hanover recently recommended the use of a new phosphatic fertiliser made with German phosphorites from the Lahn district ("Lahn-Phosphorite") and called "Germaniaphosphat".

According to an analysis made by the author, "Germaniaphosphat" contains:

Phosphoric acid	{ total	8.7 %
	{ water soluble	20.0 %
	{ citric acid soluble	6.1 %
Potassium . . .	{ total	6.3 %
	{ water soluble	5.6 %

The author tested this manure on mustard in pots, taking into consideration only the phosphoric acid and comparing it in 3 different amounts

(0.2 gr — 0.4 gr. — 1 gr. of P_2O_5) with manure containing all the chief food materials except phosphoric acid, basic slag, and "Rhenaniaphosphat". He obtained the following results:

Basic slag gave the best results; next came "Germaniaphosphat" then "Rhenaniaphosphat", which only gave yields equal to 38.74% and 48.83% respectively of the yield obtained by the use of slag". "Germaniaphosphat" is, therefore, slightly superior to "Rhenaniaphosphat".

The author considers "Germaniaphosphat" worthy of use in agriculture, but realises that his manuring experiments only have a limited value and should be repeated.

412 - The Substitution of Stassfurt Potash Salts by Finely Crushed Austrian Phonolites.

— STOKLASA, JULIUS (Director of the Physiological Chemistry Experiment Station of the Technical School of Prague), in *Oesterreichisch-ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, Year 45, Part 5 and 6, pp. 421-456, Vienna, 1916.

Much has been said in Austria during these last years in favour of phonolite powder as a substitute for Stassfurt Potash Salts. Many factories have supplied crushed phonolite, chiefly as a fertiliser for beet.

TABLE I. — Average Amounts of Potash found in the Various Potassic Phonolites of Central Bohemia.

		Origin	Total potash in the dry powder (percentage)	Potash soluble in concentrated HCl (percentage)
I. — Nepheline phonolites	1) Nepheline phonolite	Schäferberg near Ganghof	3.74 %	3.14 %
	2) Nepheline and leucite	Salasl	7.75	3.47
	<i>Idem</i>	Klumpen	6.62	3.25
II. — Nosean phonolites	3) Nosean and nepheline phonolite	Lobosch near Lobositz	8.54	3.18
	4) Nosean and leucite phonolite (hauyne and leucite phonolite)	Kelchberg near Triebtsch	6.54	3.00
	5) Nosean and sanidine phonolite	Bösig near Weisswasser	6.41	2.76
III. — Sanidine phonolites	6) Sanidine and nepheline phonolite	Schreckenstein near Aussig	6.33	2.74
	7) Sanidine and oligoclase phonolite (= Trachyt-phonolith)	Ziegenberg near Wesseln	6.84	2.04
	8) Sanidine phonolite	Klein-Priesen	7.84	1.81
	<i>Idem</i>	Proboscht	7.37	1.58

The potash contained in the phonolitic rocks of Bohemia may be estimated at many hundreds of thousand millions of tons. This phonolite is interesting because, in most cases, the nepheline is replaced by minerals of the sodalite group (usually sodalite, more rarely haityne), and also at times by analcime or natrolite. The substitution of nepheline by fairly large quantities of leucite, which occurs so frequently in the phonolites of the Eifel Mountains has not yet been found in those of the Bohemia "Mittelgebirge".

The following minerals must be considered as potash-containing constituents of these phonolites: — sanidine — anorthose — nepheline — sodalite and haityne — aegirine-augite and aegirine — natrolite and analcime. The most important potassic phonolites of central Bohemia, together with their potash content, are given in Table I.

Nepheline phonolites, nepheline and leucite phonolites, nosean and nepheline phonolites all show a similar action in the presence of concentrated hydrochloric acid. On the other hand, nosean and leucite phonolites yield less potash to this solvent, and nosean and sanidine, sanidine and nepheline, sanidine and oligoclase phonolites, still less. Sanidine phonolites give the lowest yield, nepheline phonolites the highest.

TABLE II. — *Average amount of potash soluble in concentrated hydrochloric acid in the various Bohemian phonolites in relation to the total potash.*

Phonolites	Potash soluble in concentrated HCl; percentage of total potash
Nepheline, nepheline and leucite, nosean and nepheline, nosean and leucite, nosean and sanidine, sanidine and nepheline, . . .	37.23—54.70
Sanidine and oligoclase (= "trachytphonolith" — trachytic phonolite)	20.82
Klein-Priesen sanidine.	23.09
Proboscht sanidine.	21.44
Nepheline.	54.70

SOLUBILITY OF PHONOLITE POTASH IN A SATURATED SOLUTION OF CARBONIC ACID. — Three different phonolites were carefully crushed. One hundred grammes of each powder were distributed equally among 5 large flasks, into each of which were poured 200 cc. of pure distilled water. Carbon dioxide was passed continuously through the flasks for 72 hours. Finally the amount of potash (K_2O) absorbed by the carbon dioxide solution per 100 grammes of phonolite powder was determined. The results are given in Table III.

TABLE III. — *Amount of potash dissolved by the carbon dioxide solution per 100 grammes of the 3 different phonolites.*

Phonolite	Potash dissolved; grammes	Potash dissolved; percentage of the total potash
Lobosch nosean and nepheline.	0.167	1.80
Bösig nosean and sanidine.	0.108	1.68
Klein-Priesen sanidine.	0.061	0.77

Carbon dioxide solution, therefore, dissolves relatively small amount of potash.

INFLUENCE OF PHONOLITE ON THE DEVELOPMENT OF SOIL BACTERIA
Attempts were first made to determine in what way potassic salts used as manure influence the development of bacteria. It was found that, without potash, the growth of *Azotobacter* is inhibited, whereas with potash it increases. Potassium may, therefore, be considered as indispensable to the growth of this organism.

Further experiments were made to determine whether, by bacterial action, the potash of phonolites may become water soluble. Phonolite and kainit were added alternately to the cultures of *Azotobacter chroococcum*. In 480 hours the bacteria had assimilated and transformed into organic matter about 1.7 % of K_2O in the form of phonolite. In the same length of time the bacteria transformed 8.64 % of the kainit K_2O .

The following results were obtained from similar experiments with ammonifying bacteria (*Bacillus mycoides*): — in 500 hours the bacteria dissolved and assimilated 5.6 % of finely ground phonolite potash as compared with 13 % of the potash of potassium chloride.

Microscopical examination showed that *Azotobacter* grew badly on the phonolite culture medium, but very well on the kainit medium. There are great variations in the bacterial respiration; in the phonolite medium the bacteria gave out 10.84 grammes of carbon dioxide, in the kainit medium, 27.85 grammes. Kainit, therefore, contributes largely to the development of nitrogen assimilating bacteria. Ammonifying bacteria have a similar action.

CONCLUSION. — These experiments show that potassic salts promote the growth and activity of bacteria useful to the soil. In this respect, however, phonolite is much inferior to kainit and potassium chloride.

Experiments were made on the action of phonolite on the quantitative and qualitative yields of sugar beet and barley and the results will be published at a later date.

413. **The Comparative Action of Ammonium Sulphate, Sodium Nitrate and some Organic Nitrogenous Manures: Pot Manurial Experiments in Russia.** — ЯКУШНИКОВ И. (ЯКУШНИКОВ, I.), in *Известия Московского Сельскохозяйственного Института*. (Annals of the Agricultural Institute of Moscow), Year 22, Vol. 1, pp. 137-144, Moscow, 1916.

At the present moment very little is known of the requirements of various plants with regard to any given nitrogenous manure, moreover during the last few years, many difficulties have arisen in various districts of Russia as the result of using sodium nitrate. These two facts suggested to Prof. PRIANICHNIKOV (Agricultural Institute of Moscow) the following experiments, carried out in 1914.

In damp climates sodium nitrate is easily washed out. In dry climates, on the contrary, it may accumulate on the surface of the soil and thus become injurious. Ammonium sulphate, on the other hand, is less easily washed out and is retained better by the soil. Ammonium sulphate also has other advantages. 1) it has a notable capacity for dissolving, even

in open fields; 2) its physiological acidity appears to exert a favourable influence even on exhausted soil when exhaustion is the result of an excess of bases; 3) the cost of ammonium sulphate is so low that the unit of nitrogen in it is cheaper than that of sodium nitrate.

The experiments were made with the following materials: — castor oil cake, horn-scrappings, fish manure, peat-litter manure, sodium nitrate and ammonium sulphate. The soil in the pots was taken from fields belonging to the Agricultural Institute of Moscow and the Agricultural Station of Kiev. Oats, flax and potatoes were the crops studied. Twenty-five parts (0.35 gr.) of nitrogen were added per pot, two parts of phosphoric anhydride and four parts of potassium oxide. Monopotassium phosphate and potassium chloride were used as phosphatic and potassic manures.

Observations on the growth of the plants and their weight led to the following conclusions: —

1) In clay soil ammonium sulphate is preferable to sodium nitrate. This is due to the fact that it not only dissolves the phosphates which are added, but also those which are already in the soil.

2) Horn scrapings and castor-oil cake are about equal in value to sodium nitrate. In this respect it was observed that potatoes grown in pots fertilised with horn-scrappings developed well and became dark green. Madame A. L. MASLOV has shown that, under laboratory conditions, the nitrogen of horn-scrappings becomes available fairly rapidly, more rapidly even than that of powdered dried blood. During 2 months decomposition in pots filled with soil, 20 % of blood nitrogen, 25 % of the nitrogen from horn-scrappings and 52 % of the nitrogen of the castor-oil cake were rendered available. The author considers it highly probable that the action of the horn-scrappings is not limited to the nitrogen, but extends to the sulphur, which the manure contains in large quantities. The excellent results obtained in the experiments on manuring with horn-scrappings carried out by the "Zemstvo" of the Province of Moscow, may be partly attributed to this action.

3) The assimilation of the nitrogen of fish manure (containing an average of 6.01 % of nitrogen and 9.42 % of phosphoric anhydride) did not exceed 40 to 50 % of that of sodium nitrate.

4) Peat-litter manure gives up its nitrogen more easily than manure from ordinary litter.

114. The Slow Change of Vine Wood Buried in the Soil. — PANTANELLI, E., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, Pt. 12, pp. 605-647 + plates VII-X. Modena, 1916.

It is the general opinion that scattered vegetable remains in the soil, specially when wet, are subjected to a rather rapid change which turns them to mould. In the course of research work on bramble-leaf disease of the vine (*Rendiconti dell'Accademia dei Lincei*, (5) XX, 1911, 1st. Half Year, p. 576 — *Stazioni sperimentali agrarie italiane*, XLV, 1912, p. 792) (1), it was seen that fragments of the roots or stems of vines which are bur-

(1) See also B., 1912, Nos. 572, 969, 1570.

ied in the soil remain there a long time in the living state. From May 1911 to October, 1913, the author carried out experiments at the Roy Station of Plant Pathology at Rome on the changes undergone by fragments of vine in soils according to the various degrees of moisture.

Glass cylinders of 5 litre capacity were filled with fine, homogeneous virgin, sandy loam which had been passed through a 1 mm. sieve. In each cylinder were placed vertically 8 well-wooded cuttings from which the buds had been removed. There were 5 series of 5 cylinders each of which included: 2 cylinders with unsterilised soil; 2 with earth sterilised with $\frac{1}{1000}$ phenol; 1 flask with earth sterilised by being heated 3 times for 1 hour in the autoclave at 134° C. In these cylinders were placed respectively: 1) unsterilised cuttings; 2) cuttings sterilised for $\frac{1}{2}$ hour at 134° C; 3) unsterilised cuttings; 4) cuttings pasteurised for 30 minutes at 55° C; 5) cuttings sterilised for 1 hour at 134° on 3 different days. Twenty per cent of sterilised water was added to the last series. For each series experiments were made under the following degrees of moisture: — 35%, 20% — 5% — Microscopical and chemical examinations were made in each series after 7 months, 15 months and $2\frac{1}{2}$ years. The chemical examination included the estimation of the total nitrogen, protein, a simalable carbohydrates, ash and phosphoric acid. The results are summarised as follows: —

1) Stress should be laid on the great vitality of vine-cuttings which have been stripped of their buds and buried. The wood of all the vines tested remained alive for about 15 months. The wood which showed the greatest resistance to *post mortem* decomposition was that of *Rupescr.* that of *Riparia* and of *Riparia* \times *Berlandieri* came next; that of *Vinifera* was the least resistant.

2) During the first 15 months the alterations caused were due essentially to the activity of the tissues. The following changes were observed: — solution of the starch, auto-digestion of the plasmatic protein, formation of tannic-albumin clots, condensation of gum-resin insoluble in water. The changes themselves consisted of: —

a) *humification*; concerning only the protoplasm and connected with the respiratory activity. It is an enzymatic oxidation of the decomposition products of the albuminoids, probably of the nucleo-protein with formation of *melanins*. Autogenous humification is, therefore, great and more rapid in the tissues of the bark which are rich in plasma, and the cambium;

b) *maceration* (solution of the peptones of the intercellular layer) most rapid in the parenchyma. It particularly attacks the cambium, loosening the bark, which also undergoes rapid disintegration on its inner side. On the other hand, in the wood bundles, maceration progresses slowly, starting from the circumference.

Aeration favours humification. Maceration, solution of the starch, and autodigestion of the protoplasm are more marked in very damp soil. Oxidation, which is followed by humification, preserves the plasma

proteins from an ulterior digestion. Aeration also encourages the precipitation of the albumin by tannin, and gummosis.

There are, thus, two types of alteration according to whether the soil is very dry or very damp. In the first case there is a strong autodigestion of the contents and maceration, slight humification and gummosis. In the second case there is masked humification of the contents and formation of gum, and slight autodigestion and maceration. All these autolytic processes continue after the death of the tissue.

3) The invasion of micro-organisms, particularly that of fungi, hastens these phenomena, especially maceration of the tissues rich in plasma and humification within the wood.

4) Pasteurisation does not prevent humification. Pasteurised wood macerates with difficulty, but pasteurised bark humifies and macerates more rapidly than living bark. In very damp earth the pasteurised cuttings were attacked by fungi as much as were live cuttings, and, in dry earth, to a greater extent. Sterilisation in the autoclave prevents autogenous alteration, but does not weaken the resistance of the wood to attacks of fungi, indeed, it seems to make it more resistant.

5) No bacteria were observed among the micro-organisms in the wood, but myxomycetes, actinomycetes and eumycetes were frequently found. The two former only attacked dead wood. The eumycetes alone acted as agents in the decomposition of the wood; live wood was attacked by some of them, including *Phoma vitis*, *Speira densa*, *Torula moniloides* and an *Acremonium*.

Between the autogenous alteration of the wood and that produced by fungi were quantitative differences in humification and maceration, and qualitative differences where the fungi had eliminated the lignin and dissolved the cellulose.

The tannic-albumin and the gum-resin were not attacked by fungi; in fact, humification had a preserving effect.

6) The total organic nitrogen decreased in the absence of fungi, increased in the wood attacked by these micro-organisms. The protein nitrogen increased only in the wood attacked by fungi. In other words, dried wood, when invaded by fungi, became richer in mycoprotein. Loss of the soluble nitrogen always occurs, even in immune wood, and autodigestion of the protein takes place in both live and pasteurised wood.

7) The soluble assimilable carbohydrates diminished greatly even in the absence of fungi. The insoluble assimilable carbohydrates decreased in proportion as the fungi invaded the wood. In damp soil they increased, perhaps as a result of a partial hydrolysis of the cellulose. The digestion of the carbohydrates varied with the aqueous character of the tissues. In very moist soil the starch was dissolved and loss of the sugar occurred. In dry soil there was formation of gum and destruction of the hemicelluloses. In well aerated soils the cellulose was only attacked by wood-destroying fungi, never by autodigestion.

8) In wood which was not attacked by fungi the mineral constituents diminished as a result of leaching; the increase observed in the

wood which had been attacked was in correlation with the loss of organic matter.' The phosphoric acid decreased in proportion as the wood was invaded, that is to say, the phosphoric compounds were eliminated by the mycelium. As a result of autolytic processes there was a decrease of phosphoric acid, even in the absence of fungi. This loss shows that auto-digestion of the albumins and other organic phosphoric compounds progresses greatly in the first 15 months. If, during the autolysis of these materials, compounds are formed which are harmful to higher plants, it is possible that vine wood which has been buried in the soil for two years may poison the surrounding land to a marked degree.

415 - **The Action of Bacteria and Fungi in the Tissues of Plants.** — BARTHOLD, FRICH in the *Jahrbuch für wissenschaftliche Botanik*, Year 57, Pt. 3, pp. 387-458, Leipzig, 1917

Three groups of experiments were carried out with a view to elucidating the vital relationship between plants and bacteria ;

1) Experiments on the sterility of the tissues of herbaceous plants, the sap and the heart-wood of woody plants.

2) The determination of the depth to which bacteria and fungus spores penetrate into the branches of woody plants in the water absorbed by their sections.

3) The injection of various bacteria into the tissues of herbaceous and woody plants and the determination of their longevity.

Bacteria were also placed in contact with isolated and living vegetable tissues, so that their action on living tissues, as well as on tissues treated with an alkali or an acid could be observed.

RESULTS : — 1) The normal tissues of herbaceous plants were found to be free from bacteria ; the sap and heart-wood of fibrous plants were also sterile. 2) When wood was attacked by fungi their presence could be ascertained, but not that of bacteria. It may be assumed that bacteria do not enter the wood with the mycelium of the fungi, and that bacteria cannot grow in wood attacked by fungi.

3) Bacteria and fungus spores are introduced through the vessel in the water absorbed by a section. Micro-organisms, therefore, penetrate in fairly large numbers into the branches of woody plants having long vessels, whereas bacteria were only observed on the proportionately shorter spaces in the wood whose vascular tissues have short tracheides.

4) The liquid containing bacteria and fungus spores filtered entirely through the lateral non-perforated walls of the tracheides (walls which determine the length of the latter), whereas a certain filtration took place during the passage through the unbroken parts of the vessels.

5) Bacteria injected into both live herbaceous tissues and live wood remained alive for a considerable time, in one case for more than 10 months.

6) The saprophytic life of bacteria introduced into wood was not seen to extend in any way.

7) The longevity of the bacteria may be explained by their strong resistance to exterior unfavourable conditions. Nothing was observed which would permit the assumption that the living tissues exert any action against the bacteria.

8) Although they did not die, no obvious external sign of the development of the bacteria was noticed in the isolated live plant tissues. This does not seem due to the acidity of the tissue, because, even after treatment with acid which caused the tissues to decay, they were, nevertheless, still capable of serving as a nutritive medium.

9) It appears that the tissue must be dead before its nutritive substances can be utilised by bacteria.

116 - A Saponin from *Yucca filamentosa*. — CHERNOFF, L. H., VIERHOEFER, ARNO, and JOHN CARL, O., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 2, pp. 437-443, Baltimore, Md., January, 1917.

This work was carried out at the Bureau of Chemistry, United States Department of Agriculture, Washington.

The presence of a saponin in *Yucca filamentosa* was first reported by MORRIS in 1895; SCHULZ and MEYER had obtained, in 1896, a saponin which was insoluble in water, but they did not determine its molecular weight.

The writers obtained from the dried root stock, about 6 per cent of crude saponin, $C_{44}H_{80}O_{14}$; its properties are different from those of the saponin previously extracted. It is soluble in water, alcohol, phenol and glacial acetic acid, and cannot be precipitated from the aqueous solution by neutral lead acetate, basic lead acetate and barium hydroxide. No cholesterol compound could be prepared. Haemolysis was observed after 15 minutes in the saponin solution (1 to 20 000) containing rabbit blood and kept at 37° C. The surface tension at 37° C. was 56.69 dynes per sq. cm.

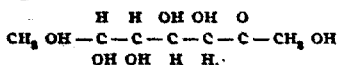
Hydrolysis of this saponin yielded a sapogenin, with no hemolytic action, a glucose, and also glucuronic acid.

The saponin is located as brownish amorphous masses in the fibro-vascular bundles of the roots and leaf bases.

117 - A New Sugar Extracted from the Fruit of the Avocado (*Persea gratissima*). — I. LA FORGE, F. B., D. Mannoketoheptose, a New Sugar from the Avocado, in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 2, pp. 511-522, Baltimore, Md., January 1917. — II. WRIGHT, F. E., Crystallographic and Optic Properties of Mannoketoheptose and of the Osazones of Mannoketoheptose and Mannaldoketoheptose, *Ibid.*, pp. 523-526, 2 fig.

I. — This work was done at the Carbohydrate Laboratory, Bureau of Chemistry, United States Department of Agriculture, Washington.

The writers isolated from the fruit of the avocado a new sugar which exists there in the free state. This fact is noteworthy, because there is thus added another monosaccharose to the small number of such substances found in a free state in nature, and of which only two, glucose and fructose, are widely distributed in any considerable quantity. The new sugar is both a ketose and a heptose, and is accordingly the 4th. natural ketose to be isolated, (the other 3 being fructose, sorbose and ketoxylose). The writer has given this new sugar the name of d-mannoketoheptose and has shown that it has the configuration :



From 350 gm. of pulp 50 g. of sugar were obtained.

In 1888, from the fruit of the avocado, *d*-perseite was extracted, a heptahydroxy alcohol which can also be obtained by the reduction of α -mannoheptose. The occurrence in the same fruit of these two similar and rare seven-carbon members of the sugar group suggests that there may be some biological relationship between them, and this view receives support from the fact that the new heptose can be transformed into *d*-perseite by reduction with sodium amalgam.

II. — Researches carried out at the Geophysical Laboratory, Washington. D-mannoketoheptose forms tabular crystals belonging to the monoclinic system, they are sphenoidal, and transparent, pale yellow in colour, and about 2 mm. in diameter.

418 — **The Part Played by Oxidases in the Improvement of Cultivated Plants; Biological Experiments and Considerations.** — DEGLI ATTÍ, M., in *Annali della R. Scuola Superiore di Agricoltura di Portici*, Vol. XIV (Reprint), Portici, 1917.

The author points out that, "since the discovery of laccase (1883), the relationship of the oxidising ferments to cultivated plants has been studied only by Prof. COMES. In 1909 Prof. COMES showed, for the first time, the importance of these ferments in the improvement of plants and their destruction of the acids of the organic juices (1). The author then summarises the principal results of his investigations:

On studying the distribution of oxidases in the organs of *Sambucus nigra* (wild elder) they were found concentrated to a marked degree in both the radical and cauline seats of neoformation. This shows the importance of oxidases in the neoformation process of the tissues. A kind of oxidasic exudate was also observed in the external parts of the extremities of the rootlets (evidently connected with the absorption functions).

Similar observations were made in the case of different varieties of Japanese medlar (*Eriobotrya japonica*). The improved variety with a longer biological cycle, whose fruit is longer, bigger, sweeter and less acid, is, all other conditions being equal, richer in oxidases than the less cultivated variety whose biological cycle is shorter, and whose fruit is round, small, less sugared and more acid.

This inverse relationship between the average amount of acidity and oxidases, and the direct relationship between the average amount of sugars and oxidases, shows up more strikingly in a comparative analysis of 3 citrus varieties, lemon, orange and mandarin. The absence of oxidising zymases in the vegetative organs of the lemon tree and their gradual disappearance from its fruit, leads to the assumption that there exists a certain incompatibility between zymotic activity and a strong excess of acid.

Analytical investigations of many varieties of European vine (high trained or low trained) and American vine (pure or hybrid) confirmed this assumption. It was seen that the amount of oxidases present increases in proportion as the vines are improved, that is to say, have a longer

(1) Cf. COMES, Del fagiuolo comune (On the Common Bean) in the *Atti del R. Istituto d'Incoraggiamento*, Naples, 1909.

biological cycle, shorter internodes, smaller foliary sinus, sweeter and less acid fruit. The above-mentioned phenomena occur also in these plants. The superficial roots contain more oxidases than the deep roots, consequently vines with deep roots (high trained vines on trellises, arches, etc), and with a relatively small geotropic angle (less-improved European vines or pure or hybrid American vines) contain insufficient oxidases in the roots. This is followed by an insufficient amount in the aerial organs, with all the results this entails — higher acidity and too little sugar.

These facts are brought still more into evidence by a comparative study of various common fruits, such as Japanese medlars, peaches, apricots, cherries, tomatoes, sorb-apples and common medlars. In each case the correlations already described are found in the reproductive organs.

Continual changes in the migration of the oxidising ferments occur during the physiological ripening of the fruit. In the first stage (that of growth) the zymotic substance is attracted to the fruit from the branch next to it, so that this substance accumulates within the ducts of either the placenta or the peduncle, whilst the sugars of the surrounding parenchyma remain acid. In the following stage (that of ripening), on the contrary, the oxidases leave the ducts, filter through the cells of the parenchyma and mix with the juices, which then gradually begin to lose their acidity. The decrease in acidity is slow in fruit which is still on the plant; on the other hand, in plucked fruit, it is exceedingly rapid.

The obvious coincidence of these facts which are certainly not related cause and effect, points to the supposition that the two phenomena are intimately connected, so much so that, in one species, it is precisely the improved varieties, those containing the most oxidases, which lose their acidity most easily and to the greatest extent. Moreover, when sorb-apples and common medlars become over-ripe, a great part of their acidity disappears at the same moment as the oxidases leave the ducts. This last phenomenon, accompanied by the loss of acidity, may proceed in a *centripetal* direction, i. e., from the external layers to the internal layers (as in sorb apples), or in a *centrifugal* direction (as in common medlars, sleepy ears and apples).

On the other hand there is no relationship between the breaking-down of the organic acid molecules by the oxidases and the increase of sugars in the fruits. Everything points to the conclusion that oxidasic combustion causes a greater simplification of the molecules themselves, and, directly, their reduction to inorganic compounds (carbonic acid and water). It is, however, probable that direct sunlight, with or without the intervention of zymases, may convert the organic acids to sugar.

All the results obtained emphasise the importance of oxidases with regard to the biology of cultivated plants and lead to the conclusion that the accumulation of oxidases is intimately connected with all cultural evolution. It is certain that those plants which have been carefully and intensively cultivated for a long time, contain more oxidases than plants of the same species which have been less highly cultivated or are wild. This proves that the zymogenic substance has its origin in cultivation, which,

in the course of many centuries, determines the main characteristics which distinguish those varieties of one species which have been improved and brought to diverse degrees of perfection.

In all districts cultivation has always consisted chiefly in manuring (with dung), irrigation and digging. The genetic connection between the nitrogen in manure and the zymogenic substance, which had already been pointed out by Prof. COMES, is thus brought very clearly into evidence.

From this substance, as yet very undefined, are derived two types of soluble ferments — hydrolysing and oxidising. The former mobilise the reserve substances, thus preparing a material more easily utilised by parasites (sugar and soluble nitrogenous substances). The latter attack and break down more particularly the acids (which make the food unpleasant) thus rendering more conspicuous the above-mentioned chemiotropic substances which are most abundant in cultivated plants (1).

It is thus seen that the action of zymotic ferments, which accumulate particularly in the tissues of highly cultivated plants, causes a series of biochemical phenomena which includes scission — grouping — breaking-up of molecules — etc.

419- The Cryoscopic Constants of Expressed Vegetable Saps as Related to the Local Environmental Conditions in the Arizona Deserts (1). — HARRIS, J. ARTHUR, and LAWRENCE, JOHN, V., with the cooperation of GORTNER ROSS, ALLEN, in *Physiological Researches*, Vol. 2, No. 1, pp. 1-49. Baltimore, Maryland, July 1916.

The many experimental data hitherto obtained exclusively in the laboratory have proved that the physico-chemical properties of the cell sap of different plants are in a large degree dependent upon the environmental conditions to which they are exposed, and change when these are altered. These conditions are: temperature, humidity of the air, light intensity, etc. It does not seem to have occurred to the plant physiologists, or the ecologists, that the results of attempts to modify the properties of the cell sap by controlling and varying conditions should also be tested out in the field. If variations in the properties of the cell sap comparable to those which may be induced in the laboratory are not to be found in nature as a result of environmental conditions, laboratory experimentation would probably lose much of its significance in plant physiology. If such variations, however, do occur in nature, they are of fundamental importance to the ecologist, phytogeographer, and evolutionist. The writers have undertaken the study of this problem, and they give the results they obtained by examining the concentration of the cell sap of various plants growing under very different conditions. This concentration, which is proportional to the freezing point lowering, can be deduced directly from the latter with the assistance of the tables *ad hoc* drawn up by HARRIS and GORTNER.

The writers proceeded as follows: the cell sap was expressed by means

(1) Cf. COMES, *La profilassi nella Patologia vegetale (Prophylaxis in Vegetable Pathology)*, in *Atti del R. Istituto d'Incoraggiamento*, Naples, 1916. — This paper is summarised in B. 1916. No. 937.

of a large screw-press and then centrifuged to clear it as much as possible. The results were expressed in freezing point lowering in degrees (Δ) by means of the usual Beckmann's thermometer which is subdivided into thousandths of a degree centigrade and provided with a very simple apparatus for the evaporation of ether. The osmotic concentration (pressures) is given in atmospheres (P). The plants examined belong to 4 groups: 1) Trees and shrubs; 2) Half-shrubs; 3) Herbaceous perennials; 4) Herbaceous annuals.

The region selected for the observations is that surrounding the Desert Laboratory in Tucson, Arizona, and is very suitable for the purpose, as within a comparatively limited area, it affords the 5 following local environments:

1) *The Foot-hill Canyons.* — Pima canyon, where the writer's collections were made, is a narrow valley with precipitous slopes and running N. E. - S. W. In spring, thanks to its sunny exposure, its vegetation is more advanced than that of other localities of the same elevation. The transient stream that flows during the spring months along the bottom of the valley, disappears as a surface feature as the season advances, but it is quite possible that during most of the year, the ligneous plants are able to draw upon an ample water supply, while their aerial portions are exposed to an atmosphere of high evaporating power and intense insolation.

2) *Cliffs, or ledges, and steeper rocky slopes.* — Here there are masses of loose rock cemented by a compact and impermeable soil which retains large quantities of water. The moisture and shade in the crevices between the blocks create persistent mesophytic conditions.

3) *Bajadas, or Mesa-like slopes.* — These are more gently sloping masses of detrital materials which form slightly inclined terraces. For a depth of 20 cm., the soil is in many places air dry during most of the year. The brevity of the period during which the soil contains sufficient water for plant growth is one of the factors that contribute to give the flora a distinct xerophytic character, those species being predominant which are furnished with a water storage system, or very deeply penetrating roots.

4) *The arroyo or wash.* — The channels, for the most part dry, of the water courses traversing the "mesa". The coarse sand and gravel, although very permeable, afford better conditions for plant growth than the surrounding "mesa", as is shown by the number of herbaceous annuals growing in spring in the most protected parts.

5) *Salt spots:* In these, there is a pronounced accumulation of alkaline salts. The Flora is halophytic (*Chenopodiaceae*).

The osmotic concentration of the cell sap varies considerably according to the different habitats, as is seen in Table I which gives the comparison of averages of the osmotic concentrations, the value for the "arroyo" being taken as unity.

The lowest osmotic concentrations are thus found in the plants growing in the arroyo, while the highest occur in those from the salt spots. To complete the data set forth in Table I, Table II shows the values of Δ (the

TABLE I. — Comparisons of averages of osmotic concentrations of the cell sap in the different groups of plants from the different habitats; the value for the arroyo is taken as unity.

Growth Form	Arroyo	Canyons	Rocky slopes	"Mesa"	Salt spots	All habitats
Trees and shrubs	1.00	1.27	1.26	1.96	2.71	1.59
Dwarf and halfshrubs	1.00	1.17	1.32	1.41	2.06	1.69
Perennial herbs	1.00	1.02	1.25	1.45	1.82	1.20
Winter annuals	1.00	1.00	1.18	1.64	—	1.14
All species	1.00	1.25	1.34	1.90	2.67	2.39

TABLE II. — Values of Δ and P in certain plants which are capable of growing in 2 or 3 different habitats.

Plants	"Arroyo"		Pima canyon		Rocky slopes		"Mesa"		Salt spots	
	Val- ues of Δ	Val- ues of P	Val- ues of Δ	Val- ues of P	Val- ues of Δ	Val- ues of P	Val- ues of Δ	Val- ues of P	Val- ues of Δ	Val- ues of P
<i>Hyptis emoryi</i> Torr.	—	—	0.96	11.6	1.13	13.6	—	—	—	—
<i>Lippia Wrightii</i> A. Gray . .	1.26	15.1	—	—	1.43	17.1	—	—	—	—
<i>Yucca macrocarpa</i> Torre En- gelmann	1.53	18.4	—	—	1.62	19.5	—	—	—	—
<i>Psilostrophe Cooperi</i> (A. Gray) Greene	1.78	21.3	—	—	—	—	1.90	22.9	—	—
<i>Eschscholzia mexicana</i> Greene	0.99	11.9	—	—	1.27	14.7	1.92	23.0	—	—
<i>Nemocris neo-mexicana</i> (A. Gray) Greene	0.74	8.9	—	—	—	—	1.17	14.1	—	—
<i>Streptanthus arizonicus</i> S. Wats	1.17	14.1	—	—	1.60	19.2	1.61	19.4	—	—
<i>Atriplex canescens</i> (Pursh) James	—	—	—	—	—	—	4.08	48.8	3.65	67.5
<i>Calycoseris Wrightii</i> A. Gray	0.97	11.6	—	—	1.12	13.5	—	—	—	—
<i>Astragalus Nuttallianus</i> D. C. Var.	1.34	16.1	—	—	1.69	20.3	—	—	—	—

freezing point lowering) and of P (osmotic concentration) in some plants which are able to grow in 2 or 3 different habitats.

On comparing the results obtained at Tucson with other data (as yet unpublished); for Long Island — Jamaica mangrove swamps — coastal deserts — mountain rain forests — and for a series of habitats in subtropical Florida — we are led to the conclusion that the study of the physico-

chemical properties is as important a part of ecological and phytological investigations as the description of the external morphology and internal structure of the species of a flora.

The cell sap is the product and the environment of all the activities of the protoplast, therefore its chemical and physical properties should be factors of fundamental importance in plant physiology. Hence it is reasonable to suppose that the differentiation of plants growing in different habitats is due partly to specific variations in the osmotic concentration of the cell sap in the several species, and partly to the direct influence of external agents on the composition of the cell sap in different individuals.

420 **New Practical and Scientific Experiments in the Selection of German Wheats Rich in Gluten.** — VON CARON-ELDINGEN, in *Deutsche Landwirtschaftliche Presse*, Year 43, No. 14, pp. 112-114, Berlin, 1916.

Since the importation of foreign wheat has stopped, German wheat bread has become more and more defective; it is hard, thick, indigestible and unpleasant to the taste. This, according to the writer, is due to the poor bread-making properties which characterise German wheats. As long as wheat could be imported from abroad German agriculturists felt little impulse to obtain varieties of good quality. Preference was given to English Squarehead wheats because of their high yield. As these varieties were not sufficiently resistant to German winters they were crossed with others. Though the wheats thus obtained were stronger and more productive, their bread-making qualities were not improved.

It is well known that the bread-making quality of wheat is closely related with the nature of its gluten and its ash content. Chemical analysis of gluten has hitherto given no data on which to base valuation, whereas investigations into its physical properties have given important results. An elastic, tough, dry gluten is good for bread-making, a soft, damp gluten of great extensibility, on the other hand, bakes badly. The higher the ash content of the flour, the less easily does it bake. The bread making capacity of wheat is shown, and judged, by the volume of bread after baking. All these characteristics must be considered if good varieties of wheat suitable for bread-making are to be obtained by selection.

Recently there has been a tendency to distinguish two types of inheritance in the vegetable world: — 1) the so-called "external" inheritance, which affects the morphological properties, is known up to a certain point (mendelism); 2) the so-called "internal" inheritance which has not yet been scientifically explained, and which affects the physiological properties; — "values", "factors" or "gens". The author is convinced by the results of crossings with wheat which he made, that the internal properties of an individual are transmitted by the dissociation of the "gens". In inheritance these are split up into positive "gens" and negative "gens" and unite with the positive and negative "gens" of the other individual to form new "gens". The accumulation of similar "gens" in this type of crossing depends on the abundance of "gens" of the other individual used in the crossing.

In practical selection, therefore, the first consideration should be an

exact analysis of the genitors, their content in moist gluten and ash as well as the quality of the gluten.

All German wheats either directly or indirectly descended from English Squarehead, should be eliminated, not only because they are poor in gluten, but also because the quality of their gluten does not meet German requirements. The gluten of English wheats is soft, moist, of great extensibility and lacking in tenacity; it is, therefore, not adapted to the purpose proposed.

Once the required internal properties have been found, the morphological properties of the genitors must be examined. The most important factor from this point of view is the capacity of giving a high yield. Experiments carried out at Eldingen and Weihenstephan show that this capacity is quite reconcilable with a high gluten content.

When the best parents have been chosen, both from a morphological and physical point of view, the practical work may begin. The desired end will only be reached if reciprocal crossings are effected and if the two new subjects show the same inheritance of internal physiological properties. It is difficult to give figures illustrating the result obtained; the best criterion is the practical yield in bread-making. This should be scientifically established in an unmistakable manner.

Up to the present there is only one variety of wheat in Germany which possesses to some degree the qualities described, this is the "Eldinger Kleberweizen", or Eldingen wheat, rich in gluten, which has been selected in that district.

421. - The Selection of Native Wheat in Hungary and Barley in Sweden; The Function of the Awns and Their Correlations with Other Characters. — See No. 430 of this Bulletin.

422 - Improvement of Black Oats by Selection and Crossing in Sweden. — NILSSON-ERLE H., in *Sveriges Utsädesförenings Tidskrift*, Year XXVI, No. 6, pp. 219-231. : fig Malmö, 1916.

This paper gives the results of a series of experiments on selection and hybridisation carried out at Svalöf from 1901-1917 in order to improve black oats in Central Sweden. The experiments may be divided into 3 parts: —

1) Attempts were made to see to what extent it is possible to improve directly, that is to say, without the introduction of foreign elements, types of native oats which are distinguished by their earliness and adaptability to very unfavourable soil and climatic conditions. *Fyrishalte* (Fyr oat) may be cited as an example resulting from the first individual and aggregate selection experiments. Whilst still retaining their characteristics of adaptability and precocity, this variety surpasses the common ones in average yield of grain.

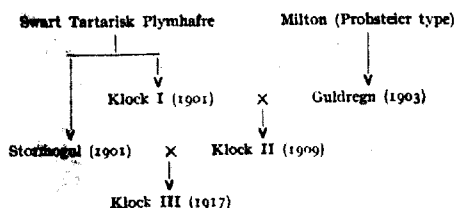
2) The native varieties, whether common or selected, always have a weak culm, and are, therefore, subject to lodging. They cannot, for this reason, be sown in light, friable and fertile soils where the rapid and considerable growth of the straw would further decrease its elasticity and

resistance. In this case use must be made of other types of black Tartar oats ("Svart Tartarish Plymhafre") with elastic and resistant culms, oats which were introduced to counteract these disadvantages, and which, little by little, have been mixed and crossed with the native types. A multifiform biological whole has thus been formed which is well adapted to selection and the isolation of the best types. In this way two well-known varieties have been obtained at Svalöf: — "Klock I" and "Stormogul", which unite in one type the productivity of native oats and the strong straw of tartar oats. "Klock I" is, moreover, remarkable for its earliness. These two new types have been successfully introduced amongst the black oats in districts where, for the reasons given above, the soil is too fertile and too rich to permit of the use of native types.

3) The third set of experiments aimed at the progressive improvement (increase in production) of black oats by hybridisation with types of white oats having a high yield. The first tangible result was "Klock II" ("Klock I" × "Guldregn") which, in productivity and the quality of its grain (see Tables I and II), is much superior to "Klock I" whilst still retaining intact its resistance and the strength of its culms. These are, doubtless, excellent and practical results, but the activities of the Svalöf Station go yet further. "Stormogul" is a variety valuable on account of its high yield of both straw and grain, but it ripens late and is thus restricted to certain districts. By crossing "Stormogul" with "Klock II" the characteristics of these two varieties have been united in one type. From amongst the descendants various lines have been isolated, the last of which is the line 01143, known as "Klock III". The great success of this crossing, apart from the earliness of the one and higher yield of the other, is due to the fact that both varieties are very similar in all other characteristics. From the 2nd. generation (F_2 ... F_n) on, numerous variations and divergences in the characteristics have been observed which have made it very difficult to fix the new hybrid. It has also not been found possible to render stable, in one individual, both precocity and a high yield in straw. For this reason the results obtained have a peculiar meaning and significance. "Klock III", though as early as "Klock II", gives a higher yield in grain than "Stormogul" (see Table III). Cultural experiments carried out in the black oat zone (Östergötland, Örebro, Stockholm, Upsal and Västmanland), fully confirm the results previously obtained at Svalöf (see Table IV). From numerous tests it may be assumed that "Klock III" is as early and has as resistant a culm as "Klock II", whilst showing a greater productivity, inherited from "Stormogul". It may be seen from the following diagram that "Klock III" is inferior to "Stormogul" only in yield of straw.

	Klock II	Klock III	Stormogul
Earliness	+	+	—
Yield in grain	—	(+)	+
Yield in straw	—	—	+

Below is the pedigree of the new variety: —



Since 1901 the "Sveriges Utsädeörening" (Swedish Society for Seed Production) placed on the market the following new varieties of black oats: — Klock I (1901) — Stormogul (1901) — Klock II (1909) — Fyris (1911) — Klock III (1917). "Fyris" gives excellent results in compact clay soils, and attempts have been made to improve it still further by crossing it with "Klock II". Thanks to their earliness and the resistance of their culms, the "Klock" types have spread rapidly, replacing the Tartar oats originally cultivated. It is highly probable that the experiments, in view or now being actually carried out, on new hybridisation of "Klock III" with "Stormogul", and of "Klock II" and "Klock III" with "Guldregn" (or other productive white oats), will still further increase the yield of black oats. There is nothing to prove that "Klock III" really represents the *best* result that can be obtained by combining "Klock II" with "Stormogul". As a rule, productivity is determined by so many factors that they are rarely transmitted all together by the parent plant to its descendants. Further crossing may, therefore, increase the number of these factors in the hybrid and thus augment its yield.

TABLE I. — Results of Comparative Cultural Experiments with the Varieties "Klock I" and "Klock II" carried out at Ultuna from 1910 to 1912.

	Yield in grain		Quality of grain			
	Kilograms per hectare	Relative index	Percentage of grains	Weight of 1 hectolitre	Weight of 1000 grains	Grain germin.
Klock II	2 422 kg	105.8	67.96 %	46.12 kg	28.35 g	1.5
Klock I	2 289 kg	100.0	66.33 %	45.86 kg	27.56 g	1.9

TABLE II. — *Comparative Cultural Experiments on "Klock I" and "Klock II". Average Results for 63 Districts of Central Sweden (1905-1909).*

	Yield in Grain		Quality of grain			
	Kilograms per hectare	Relative Index	Percentage of grains	Weight of 1 hectolitre	Weight of 1000 grains	Grains germinated
Klock II	2 704 kg.	106.1	69.34 %	47.8 kg.	28.80 gr.	1.26
Klock I	2 549 kg.	100.0	68.40 %	46.6 kg.	28.19 gr.	1.79

TABLE III. — *Results of Comparative Cultural Experiments of the varieties "Klock II", "Klock III" and "Stormogul" at Svalöf from 1912 to 1916.*

	Yield per hectare						Relative Index Klock II = 100
	1912	1913	1914	1915	1916	Averages	
	kg	kg	kg	kg	kg	kg	
<i>Grain:</i>							
Klock III	3 780	4 170	2 500	3 010	4 580	3 620	109.9
Stormogul	3 860	4 160	2 700	3 030	4 160	3 582	108.7
Klock II	3 730	3 870	2 300	2 280	4 230	3 284	100.0
<i>Straw:</i>							
Klock III	5 060	4 530	2 470	3 825	7 850	4 747	100.3
Stormogul	5 810	5 330	2 850	4 550	7 630	5 234	110.6
Klock II	5 260	4 470	2 310	4 310	7 330	4 734	100.0

TABLE IV. — *Results of Comparative Cultural Experiments with "Klock III" and other Oats, Carried out from 1914 to 1916 in the Districts Östergötland, Örebro, Stockholm, Upsal and Västmanland.*

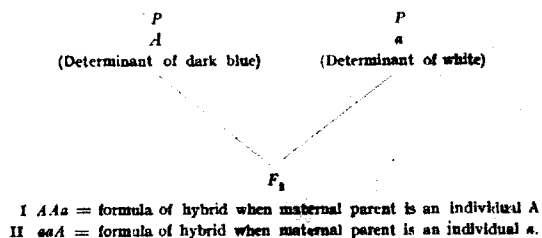
	Yield in grain per hectare (Average of all the experiments)	Relative index (Klock II = 100)
1143 Klock III	2 399	109.2
450 Stormogul	2 387	108.6
408 Klock II	2 197	100.0
1004 Fyris	2 192	100.4
slag	2 283	95.8
Black Tartar	1 832	83.5

423 - The Composition of Hybrids of *Zea Mays* L. as Regards the Structure of the Endosperm. — KENJIRO FUJII and YOSHINARI KAWADA, in *The Botanical Magazine*, Vol. XXX, No. 351, pp. 83-84. Tokyo, March 1916.

The manifestation of a character depends upon the presence of *determinants*, fundamental, indivisible, biological unities which are transmitted integrally. Each character depends either upon one, or upon several, determinants; *vice-versa*, one determinant may influence several characters. Hence the importance of investigations undertaken for the purpose of discovering the nature and number of these determinants, or *genes*, which by their different modes of segregation, or of splitting up, according to the laws discovered by MENDEL, enable the biologist to draw up biotypic formulae of the different varieties and to modify them subsequently in the desired direction by means of selection and hybridisation, suppressing the undesirable characters and replacing them by desirable ones.

In *Zea Mays* (as in most Angiosperms), the endosperm-tissue is formed by the further divisions of the primary endosperm cell, whose nucleus is the product of the union of the 2 polar (female) nuclei of the embryo-sac and one of the 2 male nuclei from the pollen tube. Every character of the triploid endosperm is thus dependent upon 1 male and 2 female determinants. Still, so far, this cytologically well-established fact has not been accounted for in the construction of the heredity-formula of maize. Owing to this fact, the actual results of crossing 2 different strains of maize are, as far as the character of the endosperm is concerned, widely different from what is theoretically to be expected.

This is exactly what happens on crossing certain strains bearing white or black seeds with other strains producing white seeds. When the *maternal* parent bears black seeds, and the *paternal* parent white, the colour of the seed in the hybrids of the 1st generation is much darker than in the inverse cross where the *maternal* parent has white seed and the *paternal* black. The zygotic formula for endosperm of a triploid nature (1 male and 2 female elements) is as follows:



Thus we see that the hybrid I has 2 determinants of blue: AA will therefore have darker seed than the hybrid II with 1 determinant: A. On the other hand, following the old formula: I) Aa and II) aA, the two different shades of blue could be explained to some extent by admitting a

inance on the maternal side, but in reality this dominance does not. The zygotic constitution of the hybrids of F_2 (the 2nd hybrid generation) is shown by the following diagrams:

Zygotic constitution of hybrids of the F_2 generation.

		Male determinants			Zygotes
Female determinants	♂	A	a		
	+				
	♀	A	a		
		AA	aa		
		Male determinants			Zygotes
Female determinants	♂	A	a		
	+				
	♀	A	a		
		AA	aa		
		Male determinants			Zygotes
Female determinants	♂	A	a		
	+				
	♀	A	a		
		AA	aa		

In diagram I, the number of male and female determinants is supposed to be identical, and there are thus only 2 kinds of blue zygotes; AA , aa or (Aa) .

On the other hand, in diagram II, where the triple character of the sperm is shown on one side, by the male determinants A and a , and the other, by the pairs of female determinants AA and aa , the number of blue zygotes is 3: $AAA - AAa - Aaa$, so that in the F_2 generation, 3 different shades of blue can be distinguished.

This new conception explains the variety of shades in the colour of grain produced by maize hybrids.

These observations regarding the character of the endosperm are applicable, not only to *Zea Mays*, but also to species of the genus *Triticum* in a general manner, to all Angiosperms in which more than 2 nuclei take part in the formation of the nucleus of the primary endosperm cell.

- Transmission of Characters in the Hybrid, *Nicotiana Tabacum* \times *N. sylvestris*. — GOODSPEED, R. H. and CLAUSEN, R. E., in *The American Naturalist*, Vol. LI, No. 601, pp. 31-46; No. 602, pp. 92-102. New York, 1917.

The researches of MORGAN and his associates on the transmission ofeditary characters in *Drosophila ampelophila* have clearly shown that factors of heredity present in the chromosomes form a linear series of which cannot displace, or replace, one another, and are united in a fixed system. The relative position of some of these loci have even been determined. When a change occurs in some locus, a corresponding change of some sort may occur in somatogenesis, so that the individual which develops from such a set of factors with the changed locus, differs in a particular way from an individual which develops from the normal series of loci; and as previously remarked, the total of the factors forms a balanced and, reacting system, so that any change in one of

the elements reacts more, or less, upon the other elements. This fact somewhat modifies the present view respecting Mendel's 3rd. law, that of the recombination of characters. In fact, the varied and easy exchange of characters and elements between one individual and another which is permitted by this law, clearly contradicts the idea of a balanced system in which, by even a slight change in the locus of the factors of heredity somatogenesis would be interfered with, and the development of a normal individual prevented. The law of the splitting and the recombination of characters, in the mendelian sense, can only be applied in a case in which the reacting systems of the 2 individuals present the closest cytological and physiological analogy. The less complete this analogy, the more each system will tend in the phenomena of character transmission to behave as an indivisible and unchangeable unit, and exclude a continually increasing number of combinations, that is to say, to be dominant.

From this point of view, the hybridisation experiments made by the writers at the University of California on two distinct species of *Nicotiana*, *N. Tabacum* and *N. sylvestris*, are of great interest. The transmission phenomena displayed by these hybrids admit of a consistent explanation, if we regard them as the outcome of a contrast of 2 distinct Mendelian reaction systems, the elements of which cannot be freely interchanged without profoundly affecting the general functions of the reaction systems thereby resulting.

When *N. Tabacum* var. *macrophylla* is crossed with *N. sylvestris*, the hybrids of the F_1 generation display throughout, down to the smallest details, the anatomical and physiological type of *N. T. macrophylla* (with no trace of *sylvestris*) namely: rose-red flowers — pentagonal limb, short, stout corolla tube, etc.

If on the contrary, *N. Tabacum* var. *angustifolia* is crossed with *N. sylvestris*, the hybrids are completely different from the preceding ones on account of the entire predominance of the characters of *N. T. angustifolia* — pink flowers; leaves ovate-lanceolate, not erect like those of *N. sylvestris*, but graceful and drooping.

On the other hand, the F_1 hybrids of varieties of the same species: *N. Tabacum*, present intermediate characters with no predominance of the characters of either variety. In this case, there is not a contrast between two distinct Mendelian reaction systems, but merely a contrast of certain differences within a common system, and the differences are due to slight variations in one factor, or in a very limited number of factors.

In species hybrids, however, the contrast is between distinct Mendelian reaction systems of which the elements form an unchangeable physiological whole, and one of these systems entirely predominates over the other.

A high degree of incompatibility between the factors (loci) of the system is shown by sterility in the F_1 generation. As GOODSPEED has shown, it is not a question of complete, but only of partial, sterility, with the formation of some ovules which are capable of fertilisation and development. The small number of fertile ovules and pollen grains represent the extreme values of recombination between *N. Tabacum* and *N. sylvestris*. On the

other hand, in the majority of cases, given the incompatibility of the two gametes, the gametic combinations that can be theoretically predicted are of no functional importance, and give rise to sterile elements.

15 - **Hereditary Anomalies of the Flower of *Nicotiana Tabacum* Observed in Germany.** — KLEBS, GEORG, in the *Zeitschrift für induktive Abstammungs und Vererbungslehre*, Vol. 17, Pt. 1-2, pp. 53-117, Leipzig, November 1916.

This paper describes hereditary anomalies in the flower of a stock plant of *Nicotiana Tabacum*, which, in the spring of 1909, grew fortuitously in a green-house in a pot where tropical plants were cultivated. Although *Nicotiana Tabacum* is annual, the plant in question grew during consecutive years and flowered 6 times. It died in March, 1912, after the capsules had ripened. The plant was very carefully observed from 1909 to 1912 and, throughout its existence, proved extremely typical. Cuttings from this plant, grown in a warm bed under special conditions, showed many anomalies, some of which proved of importance in subsequent observations.

Seeds were obtained from the plant by self-fertilisation and sown for the first time in the spring of 1910. On superficial examination the 80 plants showed no peculiarities. The second sowing was carried out in February 1912, with seeds of the same plant in unsterilised soil. The seedlings were then transplanted in the open, partly under different conditions.

Among the 460 samples cultivated in the open the flowers of one plant showed an abnormal structure (mutation), which the author called "*lacerata*" form. All the other subjects showed concordant characteristics, both in vegetative structure and general organisation of the flowers. The mutation only differs from the typical ("*typica*") stock form in the flowers, the difference being quantitative. Its most characteristic peculiarity is that, in 50% of the flowers, the corolla is crenated or torn at the side, a condition found only in from 0.2 to 2.6% of the "*typica*" form. Other abnormal characteristics of the calyx are still more marked. The "*lacerata*" form may be defined as an intermediary type, "rich in anomalies" whereas the "*typica*" form may be called "poor in anomalies".

In 1913, new descendants of the stock plant (446) were obtained; 967 flowers were examined 2.6% of which showed crenated corollas. In 1914, the percentage of this anomaly was 0.23, and in 1915, 0.25.

The subsequent behaviour of the "*lacerata*" form is of special interest. By means of self-fertilisation it produced three types of descendants, the percentages for which are given below:—

	1913	1914	1915
<i>lacerata</i>	56.0%	47.5%	50.6%
<i>typica</i>	29.7	38.1	29.5
<i>apetala</i>	14.3	14.4	19.9

From this segregation the author concludes that the "*lacerata*" form is a hybrid of the *Zea* type, but with certain deviations. It is derived, by mutation of the hybrid, from the "*typica*" form.

New hybridisations were carried out to study the nature of these forms. In 1914, by crossing the stock plant with the "*apetala*" form, 134 plants were obtained, all of which showed the "*lacerata*" character. In these plants separated out in the following proportions:

<i>lacerata</i>	50.0 %
<i>typica</i>	31.1
<i>apetala</i>	18.9

By reciprocal crossing of the "*lacerata*" form with the "*apetala*" form, 54.7 % of "*lacerata*" forms, and 45.3 % of "*apetala*" forms, were obtained. This is in agreement with Mendel's law. Reciprocal crossing of "*lacerata*" with "*typica*" has not yet given concordant results.

426 - Behaviour of Tobacco "Variations", in Java. — JENSEN, H., in *Proefstation Vorstenlandsche Tabak, Mededeeling* No. XXIV, pp. 41-56. Semarang, 1916.

A description is given of experiments carried out to ascertain whether *Nicotiana Tabacum* plants with abnormally long or short stems and normally large or small blades, transmit these peculiarities to their descendants. In other words, the aim was to determine whether positive or negative variations are fluctuations due to the irregular action of external agents, and, consequently, untransmissible, or whether they are mutations, due to a modification of the germ-plasm and transmissible to the descendants with ever increasing distinctness. In the second case the breeder could make use of the variations to improve a given variety, whereas, in the first case, they would be of no practical use. The variations may be divided into two parts: — 1) the consideration of the length of the stems, 2) the consideration of the dimensions of the blades.

I. — LENGTH OF THE PLANTS. — Experiments were begun in 1911 on 6 samples of which 2 (Nos. 35 and 38) were of the pure strain Y₁₀, selected by LODEWIJKS, and 4 (Nos. 34, 36, 37, 39) derived from the 3rd generation of the pure strain WY, descended from plant No. 27, selected in 1911. Certain descendants of this plant (Nos. 201, 216, 218) had been set aside in 1912, and, in 1913, the 4 above-mentioned samples, Nos. 36, 37, 39 had been isolated from among the descendants of Nos. 201, 218, to serve as parent plants in these experiments. The lengths of the samples were as follows: —

No. 31 (descended from plant No. 218 of 1912)	119 cm.
No. 36 (descended from plant No. 216 of 1912)	118 cm.
No. 37 (descended from plant No. 201 of 1912)	142 cm.
No. 39 (descended from plant No. 201 of 1912)	224 cm.

Nos. 37 and 39, therefore, had the same mother, and all four samples the same ancestor (No. 27). Taking into consideration the close relationship and the identity of the resulting biotypical formulae, the variations could only be fluctuations or mutations. If it is a case of fluctuations there should be no real differences between the descendants of long and short individuals in the average length and the value of the deviation.

from the average. If, on the other hand, it is a question of mutations, the longest and the shortest individuals will tend to procreate long individuals and short individuals respectively, and the average lengths of the two groups of descendants will differ notably one from the other.

Table I gives a summary of the biometrical data concerning the stem.

TABLE I. — *Biometrical Data Concerning the Stem of the Strain WY.*

Parent Plants		Descendants			
Numbers	Length	Average Length	Average error in the determination of this length	Deviation from the average	Variation coefficient
34	119 cm	227.08 cm	0.77	10.160	4.47
35	72	223.11	0.91	12.065	5.41
36	118	231.74	0.75	11.229	4.85
37	142	203.36	0.99	13.376	6.57
38	224	219.24	0.63	8.308	3.79
39	224	208.89	0.85	11.585	5.56

Although external conditions, and, above all, irregularities of the soil, may have influenced the development of the plants, making analysis more difficult, yet examination of these data shows that there is no proportionate difference between the descendants of long and of short individuals. In some special cases, long samples produced shorter descendants than certain short samples. It would appear, therefore, that, in tobacco, variations in the length of the stem are non-transmissible fluctuations.

II. — DIMENSIONS OF THE BLADES. — The investigations were begun in 1913-1914 on a pure "Kanari" strain and a Y strain, in all 55 544 leaves being measured in length and breadth.

For the "Kanari" strain a plant of the 7th. generation with the number 118 was taken as starting-point. In this plant the ratio *length : breadth* of the blade equalled 1.8, that is to say, for the "Kanari" type, it had relatively broad leaves. From among the descendants of this plant (8th. generation) 27 were selected, of which No. 7 had a ratio of 2.1 (narrow leaves), and No. 14 a ratio of 1.9 (broad leaves). These were, therefore, two individuals which, although belonging to a pure strain, showed very strong variations. In 1913-1914, 5 490 leaves of No. 118, 11 786 leaves of No. 14 and 12 382 leaves of No. 7 were measured. The biometrical data are given in Table II.

Table II shows that, in 1913, the leaves of the whole plantation were relatively little developed (on account of meteorological conditions), and no difference in the behaviour of the various descendants can be distinguished. The biometrical values of the different groups are equal. It is thus

TABLE II. — *Biometrical Data Concerning the Leaf of the "Kanari" Strain.*

Parent Plants		Progeny				
Number	Length Breadth Ratio of Blade	Number of leaves measured	Length Breadth ratio of blade	Average error in the determination of this ratio	Deviation from average	Variation coefficient
No. 118 (1911)	1.8	5 490	2.2435	0.02276	0.2276	10.1
No. 14 (1912)	1.9	11 786	2.2520	0.02288	0.2288	10.1
No. 7 (1912)	2.1	12 382	2.2477	0.02293	0.2293	10.1

seen that the genotype of the pure "Kanari" strain is not subject to permanent modifications with regard to the "dimensions of the blade", so that plants with wide leaves and plants with narrow leaves produce descendants showing no difference in the dimensions of the blade.

The starting point for the strain W Y was No. 27 with small leaves and a length : breadth ratio of 2.05. From amongst its descendants two plants were chosen; one with very wide leaves No. 207, and one with rather small leaves, No. 202. The descendants of Nos. 27, 207 and 204 were studied comparatively in 1913. The most important biometrical results are summarised in Table III.

TABLE III. — *Biometrical Data Concerning the Leaf in the Strain WY.*

Parent Plants		Progeny				
	Length Breadth ratio of blade	Number of leaves measured	Length Breadth ratio of blade	Average error in the determination of this ratio	Deviation from average	Variation coefficient
No. 27	2.05	5 391	2.2238	0.02174	0.2174	9.77
No. 207	1.82	10 178	2.2435	0.02232	0.2232	9.95
No. 204	1.98	10 317	2.2808	0.02185	0.2185	9.58

CONCLUSION : — The descendants of both positive and negative variations differ in no way among themselves and show the same average dimensions. In the choice of plants for seed, therefore, where pure strains are concerned, it is unnecessary to take into consideration either the length of the stems or dimensions of the leaves, for neither of the features are transmitted to the progeny.

27. The Behaviour of "Bolting" Beets. — MUNERATI, O. and ZAPPAROLI, T. V., in *Le Stazioni Sperimentali Agricole Italiane*, Vol. I. Part. 1, pp. 5-24. Modena, 1917.

After giving a rapid review of the chief work already done on this subject the authors describe the experiments which they themselves carried out at the "R. Stazione Sperimentale di Bieticoltura" of Rovigo (Royal Experimental Station for Beet Cultivation).

In 1912, by means of the isolator invented by Prof. MUNERATI to prevent the cross-fertilisation of parent beets, a fairly large number of annual plants in flower were isolated, and seed was obtained from about 40 samples.

In the spring of 1913 the glomerules of these samples were sown in separate plots. In this first generation a great difference was immediately evident between the various groups in the percentage of beets which flowered in the first year. At harvest time this percentage varied from 0 to 95.

The question arose as to whether the tendency to transmit premature flowering was connected with precocious production of the flowering shoot or shoots. The following facts were largely observed in all beet-fields in which the plants bolted:

a) Bolting plants nearly always have a single, very strong shoot with but few leaves, or having few leaves only at the base, and a thin, and usually more or less woody, root. These are plants which, in the Lower Valley of the Po where beets are sown in the last days of February or the first fortnight of March, have their seeds already ripe in the first fortnight of August.

b) plants which usually seed late have a stem abundantly covered with leaves and with many leaves at the base, a thick root, similar to that of biennials, which is but slightly or not at all woody. Under the same conditions the seed ripens only towards the middle of October, or even later.

c) plants with a more or less elongated stem terminating in a rosette; these are called "rosettes".

In 1913 the authors isolated several plants of the *a* and *b* groups. The seed was harvested *a*) in the middle of August (early) — *b*) from the middle to the end of October (late), respectively. At the same time a certain number of the "rosettes" *c*) were kept, and fructified under an isolator in the following year (1914).

The seed of groups *a* and *b* was put into the ground on the 4th. March, 1914. The crop obtained showed that beets with a tendency to bolting transmit their character to their descendants to a much more marked degree than those which seed late.

The experiments were continued in 1914 on the following bases:

a) the gathering in common sugar beet fields, as in the preceding years; of samples which were going to seed, the early and late flowering ones being kept apart and successively separated;

b) the isolation of annuals, early or late, according to strains derived from annual plants;

c) the gathering in mass of the seeds from early or late annuals descended from strains of annual beets;

d) the fructifying of the 1913 "rosettes" in isolators.

The sowing of these seeds was carried out twice in 1915, on the March and the 26th April. The number of biennial and early and annual plants and the percentage of annuals were determined for each variety.

The flowering periods of the cultivated beet were compared with that of the wild beet (*Beta maritima*) with the following results:

Date of sowing	Percentage of annuals obtained	
	from wild beet seed	from common cultivated (biennial) beet seed
February 23rd	85.5	12
March 15th	82	2
March 28th	82	—
April 28th	79	—
June 15th	39	—
August 9th	—	—

When sown very early, then, wild beet may give as much as 90% annuals and cultivated beet from 10 to 15%. When sown fairly late, cultivated beets produce only biennial descendants, whereas wild beets give a good proportion of annuals. Finally, when sowing is very late, the wild beet ceases to produce annuals. So far as the influence of the date of sowing is concerned, therefore, the wild beet reproduces the character of the cultivated beet, but to a much more marked degree.

The descendants of annual beets derived from biennial beets sometimes resemble the wild type, sometimes the cultivated type in their behavior; the former may even surpass the wild type. Thus, in 1916, 98 and 99% of annuals were derived from 2 strains of biennial beets respectively opposed to 82% obtained from the seed of wild beets.

These results led to the following conclusions:

1) The contrary results obtained by other workers who have studied the progeny of annual beets derived from biennial may be due to differences in the plant material from which these workers started.

2) By isolating the plants in flower and by studying the descendants in separate strains, it is possible to verify amongst the descendants themselves a behaviour which varies distinctly according to the plants from which they are derived;

a) there are annuals the greater part of whose progeny show tendency to bolting;

b) there are, on the other hand, bolting plants, whose descendants under the same conditions as the preceding plants, prove, almost without exception, to be biennials.

3) In a general way, given similar conditions :

a) bolting beets have a greater tendency to produce annuals (these beets are nearly always characterised by the absence or small number of leaves at their base and on the stems, by small, thin roots of more or less woody tissue) ;

b) beets which seed late rarely transmit to any marked degree the tendency to produce annuals (these beets usually have abundant leaves along the stems and at their base, the weight of the root is normal and its tissue is only slightly, if at all, woody) ;

c) beets descended from the "rosette" type, show this tendency either to a very slight extent or not at all (1).

4) In all cases, under similar conditions, beets which bolt in certain years (a phenomenon which is still unexplained) produce descendants in which the tendency to perpetuate this characteristic is more sharply defined than in the descendants of plants which bolt in other years.

5) As the beet, both when cultivated and when wild, produces annual as well as biennial, or even perennial types, it is not possible, strictly speaking, to say that cultivated bolting beets show a return to a primitive type (2). It can only be said that, in the wild type, the equilibrium tends towards annual production and, in the cultivated type, to biennial production. It is, however, easy, both in the wild and in the cultivated type, to obtain strains in which the annual character dominates and vice versa, by starting respectively from plants having the opposite characteristics.

6) Early sowing, followed by inhibition of growth, increases the proportion of bolting plants in every case. When, however, the equilibrium of a given strain tends towards annual production, early sowing and inhibition of growth no longer form a *necessary* condition for the production of a high percentage of bolting plants : this percentage is obtained with both early or relatively late sowings. If, in the Lower Valley of the Po, the seeds are sown towards the end of April, that is to say, when variations in temperature will no longer cause any appreciable inhibition of growth (3), these strains yield more than 90 % of annuals, about the same percentage as would have been obtained had they been sown two months earlier. Still later sowing (from the end of May to the beginning of June) causes a rapid decrease in seeding plants, even eliminating them entirely. In this case the biennial characteristic is purely transitory.

7) Although it is relatively easy to increase or diminish the tendency

(1) A large number of "rosettes" is obtained by sowing annual strains late; in this case, which fundamentally differs from the one under consideration, the progeny of the "rosettes" repeat the bolting characteristic. Experiments are being made to determine whether, by very early sowing, it is possible to obtain the annual characteristic to an appreciable extent in the descendants of "rosettes" from a normal sowing.

(2) The term "prefloration", which is perfectly suitable when the beet is considered in its customary aspect of a cultivated plant of a biennial cycle destined to commercial uses, is no longer appropriate when the phenomenon is considered from the point of view above.

(3) Common sugar beets, if sown towards the end of April, give exactly 100% of biennials.

of varieties towards an annual or a biennial character by special conditions (germination period, inhibition of vegetation, soil fertility, shade, etc.), it is not possible to fix the respective annual (1) or biennial characteristics in any stable or absolute manner. In other words, the beet belongs to that category of species described by DE VRIES as "unfixable", "facultatively annual or biennial", in which "continuous selection does not free biennial strains from the tendency to bolt, nor annual strains from their tendency to produce biennials". (*Mutations-theorie*, I, pp. 616-626).

The bolting of beets is thus reduced to one of the simplest and most natural manifestations of the life of the species.

428 - **A New Method of Wheat Cultivation Advocated by Mr. Devaux** (2). — SCHIRIAUX (Professor of the National Agricultural Institute), in *La Vie agricole et rurale*, No. 10, pp. 177-178, Paris, March 9, 1917.

The method advocated by MR. DEVAUX (that advised by DEMT-SCHINSKY in Russia) requires to be carefully carried out and, for this reason, cannot be adopted extensively. Moreover, very early sowing, in August or the first days of September, is but rarely possible because the ground is either occupied by other crops or is still insufficiently prepared. Early sowings also suffer from the winter cold, the attacks of insects and trampling. The multiplication of the culms delays the development of the wheat, and, with thin sowing and hilling up there is danger of scorching. The grain, too, would be of inferior quality. Abundant tillering is recognised to day as a fault, not as a good quality.

The method advocated by MR. DEVAUX may be recommended when it is necessary to increase the production of a new variety of wheat of which only a few seeds are available, but it is neither possible nor advisable in cultivation on a large scale.

429 - **Results of Experiments on the Cultivation of Spring Wheats at Valdichiana, Tuscany, Italy.** — VIGIANI, DANTE, in *L'Agricoltura toscana*, Year VIII, Pt. 2, pp. 25-26, Florence, January 31, 1917.

Many experiments in the cultivation of spring wheats were carried out in different districts of Valdichiana (province of Arezzo), particularly in the grounds of the Vegni Agricultural Institute at Barullo. From these experiments the success of spring sowings was seen to depend on special factors: abundant sowing (116 to 142 lbs. per acre) never later than the first days of March; manuring with superphosphates; weeding. The most important of these factors is early sowing; in Valdichiana the most

(1) It should be noted that, in 1876, RIMPAU obtained 100 % of annuals from a strain which was chiefly annual, sown on the 31st March. (*Das Aufschliessen der Runkelrüben*, in *Landwirtschaftliche Jahrbücher*, Band V (1876), Heft 1; Band IX (1880), Heft 1, but the number of plants observed, barely 50, was too limited to permit this percentage to be accepted as typical).

(2) M. DEVAUX: 1) Cultural Methods which give a large increase in wheat yield, in *Comptes Rendus de l'Académie des Sciences*, January 22, 1917. — 2) "The Effects of Early Sowing, hilling-up and Topping on the Growth of Wheat", in *Comptes Rendus de l'Académie d'Agriculture de France*, January 24, 1917.

See also B. April, 1917, No. 327.

(Ed.).

favourable month is February ; when sowing was as late as the end of March the results were disastrous. The following varieties were found most subject to rust: - first "Noè marzuolo", then, in order, "Ferrarese", "American", "Chiddam", "Marzuolo dell'Amiata", "Marzuolo comune", "Veronese", "Marzuolo della valle del Savio".

The best results were obtained with "Marzuolo americano" and "Monte Amiata", both of which tend to tiller rather more than the other varieties. The variety "Gentil rosso" ("Calbigia rossa") often recommended as a spring wheat, was found to complete its vegetative cycle in a short time.

130 - **The Importance of the Awns of Native Wheat in Hungary and of Barley in Sweden.** — I. FLEISCHMANN, RUDOLF, The Importance of the Awns in Native Hungarian Wheat, in *Zeitschrift für Pflanzenzüchtung*, Vol. 4, Pt. 4, pp. 335-346. Berlin, December, 1916. — II. TEDIN, HANS, The Effects of the Removal of the Awns on the Development of Barley Grain, Sweden, in *Sveriges Utsädesförnings Tidskrift*, Year XXVI, Pt. 6, pp. 245-253; Malmö, 1916.

I. — THE IMPORTANCE OF THE AWNS IN NATIVE HUNGARIAN WHEAT.

While selecting this wheat the author isolated forms which showed remarkable differences in the awns. In order to determine these differences with greater exactitude he chose, from among many stock types, 3 average ears of each which best showed the configuration of the awns. On each of these he measured the length of the awn and the length of the glumes.

The strains studied were then divided into 3 type-groups according to the ratio "length of awn" : "length of glume" (without awn) :

A : Complete absence of awns. Tip of the glume either completely rounded or showing only a small spur-shaped projection which cannot be called an awn. This is the "A type", or "hooded type" ("Kapuzentyus").

B : Distinct awns, but of an average length less than, or, at the most, equal to, the average length of the glumes (without the awn). This is the "B type", or "short-bearded type" (Kurzgrannentypus).

C : Average length of the awns exceeding that of the glumes. This is the "C type" or "long-bearded type" (Langgrannentypus).

Attempts were made to determine whether there is any correlation between the length of the awn and certain important agricultural qualities of native Hungarian wheat, and the following facts were established :

- 1) Both the ears and leaves of the "A hooded type" are much less resistant to yellow rust than types *B* and *C*.
- 2) Plants giving a low yield are more frequent in type *A* ; those giving a high yield are more frequent in types *B* and *C*.
- 3) The weight of 1000 grains is less in plants of type *A* than in those of types *B* and *C*.

No correlation could be established between the weights of 1 hectolitre of grain.

4) The average diameter of the grain is less in type *A* than in the types *B* and *C*.

5) Type *A* has shorter straw than types *B* and *C* ; it is also of a weaker and finer structure.

6) Type *A* usually ripens before the other types.

7) Forms related to type *A* appear, on an average, to be less susceptible to smut, but no exact correlations could be established.

In a general way, plants of type *A* remain within the limits characteristic of native Hungarian wheat. The ear is generally weak and delicate, in accordance with the whole structure of the plant. In years when rust is not rife these forms give a good grain of high quality but their susceptibility to yellow rust compromises the security of the crop.

Types *B* and *C*, on the other hand, show a great difference in development and diverge more or less from the ordinary native Hungarian wheat. They are vigorous types, with abundant vegetation and with a longer straw, larger and heavier grains than type *A*. They are more resistant to rust and much more productive.

It is still too early to give any definite opinion on the value of the two types *B* and *C* from the point of view of selection. Further experiments are necessary, particularly the testing of the characteristics and value of the descendants. It seems, however, permissible to assume that, in selection, better results may be obtained from type *C* than from type *B*.

II. THE EFFECTS OF THE REMOVAL OF THE AWNS ON THE DEVELOPMENT OF BARLEY GRAIN, SWEDEN. — It is known that removal of the awns immediately after earing changes the transpiration process and also greatly influences development of the grains, their quality and their quantity.

On the 3rd. and 4th. August 1916, just when the barley was about to ripen, a district of Sweden, which included Svalöf, suffered from two violent gales during which the wind sometimes attained a velocity of nearly 2 miles a minute. Great damage was done to cereals at Svalöf; culms were broken, the grain fell and, above all, there was partial or total loss of awns.

Although development was very advanced the loss of the awns did not fail to influence the phenomena of growth and caused a rapid and irregular ripening of the grain while the straw was still green, especially round the nodes. Attempts were made to determine the total amount of damage due to loss of the awns. The most important results are given in the following table:

Losses in Weight of Barley Grains at Svalöf due to Removal of the Awns.

Varieties of Barley studied	Weight of 1000 grains		Loss due to removal of the awns	
	from ears with awns	from ears stripped of their awns		
Svalöf's Prinzess	43.3 g.	39.8 g.	3.5 g.	8.1 %
• Chevalier II	45.7	38.9	6.8	14.9
• 0184	46.5	42.0	4.5	9.7
• 0187	46.4	41.9	4.5	9.7
• 0250	39.3	38.0	1.3	3.3
• 0412	46.9	42.8	4.1	8.7
• id.	47.5	37.8	9.7	20.4
• Guldkorn	41.7	39.8	1.9	4.6

This table shows that, without exception, the weight of 1000 grains in barley from ears stripped of their awns. The decrease varies considerably in the different varieties with a maximum of 20.4 % for "Svalöf's 2" and a minimum of 3.3 % for "Svalöf's 0 250".

It may not prove impossible to increase the robustness and resistance of the awns by suitable crossings so that they may constitute a valuable characteristic in districts where gales and storms are frequent during the ripening period of cereals.

Wild and Cultivated Fodder Crops of the Bombay Presidency, India. — I. MANN, ARTHUR H., Fodder Crops of Western India, in the *Department of Agriculture, Bombay*, Bulletin No. 77 of 1916, pp. 142. Poona, 1916 — II. BURNS, W., BHIDE, R. K., KULKARNI, S. B. and HANMANTE, N. M., Some Wild Fodder Plants of the Bombay Presidency. *Ibid.* Bulletin, No. 78 of 1916, pp. 24 + XXXIV plates.

I. — This paper gives a compilation of what is at present known concerning the most suitable fodder crops in various parts of Western India, particularly in the Bombay Presidency. Special consideration is given to the locality in which each crop is likely to prove most useful, the best methods of cultivation, the yield hitherto obtained and the value of the forage produced.

The following plants have been studied :

GRAMINACEAE : "Jowar" (*Andropogon Sorghum*) — Maize — "Bajri" (*Pennisetum typhalum*) — "Kang" or "Rala" (*Setaria italica*) — "Cheno" (*Panicum miliaceum* and *Panicum miliare*) — "Nachani" (*Eleusine coracana*) — "Sawan" (*Panicum trimeleticum*) — Banti" (*Panicum Crus-galli*) — Oats — "Guinea grass" (*Panicum maximum*) — "Teo" (*Euchloa mexicana* = *Reana luxurians*) — "Baru" (*Andropogon halepensis*) — "Eleon Crown Grass" (*Paspalum dilatatum*) — "Mauritius water grass" or "Para grass" (*Pennisetum muticum* = *P. molle* = *P. barbinodum*) — "Rhodes grass" (*Chloris Gayana*).

The cultivation of the four following fodder crops is advised :

"Red Teff grass" (*Eragrostis abyssinica*) — "Sudan grass" (*Sorghum exiguum*) — "Eleon grass" (*Pennisetum purpureum*) — "Marvel grass" (*Andropogon annulatus*).
LEGUMINOSAE : Lucerne — "Berseem" or "Egyptian Clover" — "Shaftal" or "Per-Clover" (*Trifolium resupinatum*) — "Senji" (*Melilotus alba* = *M. indica*) — "Chavil" or "Gafang" — "Vul" (*Dolichos lablab*) — "Kulthi" (*Dolichos biflorus*) — "Guar" — "Custer Bean" (*Cyamopsis tetralonioides*) — Soybean (*Glycine max* = *Glycine soja*) — *Pisum* — "Methi" or "Penu-teek" (*Trigonella foenum-graecum*) — "Uddi" (*Phaseolus vulgaris radiatus*) — "Mug" (*Phaseolus mungo*) — "Matl" or "Matli" (*Phaseolus acutius*) — "Sana Hemp" (*Crotalaria juncea*) — "Florida Velvet Bean" (*Stizolobium quadratum*) — "Florida Beggar Weed" (*Desmodium tortuosum*) — "Japan Clover" (*Lespedeza striata*) — Vetch (*Vicia sativa*) — Sainfoin (*Onobrychis viciifolia*) — *Lathyrus sylvestris* — *Wagneri*.

II. — This bulletin gives a concise description of the following wild plants used in India either as hay or pasture. The local name, habitat, history, chemical composition, feeding value and a plate of each plant are given :

Andropogon annulatus — *A. monticola* — *A. triticus* — *A. confertus* — *A. pumilus* — *A. effusus* — *A. Lawsoni* — *A. purpureo-sericeus* — *A. halepensis* — *Ischaemum pilosum* —

I. sulcatum—*Iscilema Wightii*—*Iscilema antheophoroides*—*Panicum Isachne*—*Chloris barbata*—*Chloris virgata*—*Paspalum sanguinale*—*Dinebra arabica*—*Pennisetum cenchroides*—*Cenchrus biflorus*—*Apluda varia*—*Thelipogon elegans*—*Eleusine acgyptica*—*Anthistaria ciliata*—*Indigofera glandulosa*—*I. trifoliata*—*I. limifolia*—*Alysicarpus pubescens*—*A. rugosus*—*A. longifolius*—*Psoralea corylifolia*—*Sesbania aculeata*—*Hylandia laevis*—*Tephrosia purpurea*.

432 — **Transplanting Alfalfa.** — HANSEN, N. E. in *Agricultural Experiment Station, South Dakota State College of Agricultural and Mechanic Arts, Department of Horticulture Bulletin No. 167*, pp. 423-445, Fig. 8. Brookings, South Dakota, June 1916.

In the spring of 1907, the writer bought small lots of new alfalfas from Siberia and other parts of Russia. As it was very necessary that as large an acreage should be obtained as possible, the alfalfa was planted in rows, and the ground was kept clean and hoed. These transplanted individuals made such tremendous growth, that the writer has continued to work along this line, and in the spring of 1912, he started the machine transplanting of alfalfa.

Three different makes of transplanting machines were tried, but the best results were obtained with the Bemis transplanter made by the MASON PLOW COMPANY, Madison, Wisconsin. This machine is now extensively used for transplanting tobacco, cabbages and other vegetables, various flowering plants and bulbs, as well as for small tree seedlings and cuttings. The many uses to which this machine can be applied make it also very useful to nurserymen. There are now about 100,000 transplanting machines in use in the United States and other countries. One of these machines can transplant from 7 to 8 acres of alfalfa per day; a small one costs about \$70.

The illustrations accompanying the article show the large dimensions attained by the transplanted alfalfa: the stems measured 7 ft. 2 in. and the much-ramified root, about 40 inches in length, while the dry weight was 8 lbs. One plant of the Cossack variety bears 3 oz. of seed the third year, if transplanted the first year from seed. This is at a rate of 1,022 lbs. of seed per acre.

In order to obtain good results from transplanting, a variety must be chosen which will respond to being given plenty of space. Common alfalfa does not stool out or branch enough. The Russian varieties Cossack and Semipalatinsk are very suitable for this mode of cultivation; the latter does well on the driest uplands. The writer is of opinion that the transplanting of alfalfa will be the means of reclaiming millions of acres of dry land, or of very argillaceous soil where now it is difficult to get a stand. The method is also effective as a means of attaining various ends: better seed production, inoculation, hybridising, etc.

Transplanting may be carried out in the autumn of the first year. Plants which it is impossible to transplant should be kept in outdoor cellars, or may be heeled in close together in furrows made with a plough. The writer has transplanted as late as early June with good results; it is, however, better to set the plants before the new shoots have made too much growth. The plants, as a rule, should be set 2 × 4 ft apart; for selection purposes they should be at a greater distance from one another, at least 4 × 6.

It is not necessary to water the plants after they are transplanted. If set in dry ground, they will keep alive for many days until rain comes. The Semipalatinsk variety is especially tenacious of life in this respect. In autumn-transplanting, it is especially necessary to set the plants 2 inches deeper than they stood, so that the crowns are entirely covered with earth, this avoids excessive drying out during the winter. In spring-transplanting, the crowns should be barely covered, but enough to allow for settling of the loose earth.

Hay from transplanted alfalfa, while perhaps coarse-stemmed for the first 2 or 3 years, soon becomes fine, as the stems increase so quickly in number (often 500 by the 2nd. year). Further, the stems of transplanted plants are more leafy than in broadcast fields. Transplanted alfalfa ought not to be cut the first year, as the top is needed to give strength to the roots.

The transplanting method has led to a quick way of hybridising alfalfa. This is effected spontaneously by planting the 2 varieties alternately. In this manner, the writer obtained a hybrid between the yellow-flowered and the blue-flowered Siberian varieties which proved very resistant to the frosts of early autumn and of late spring.

The writer does not advise that alfalfa transplanting should be generally adopted. The method must be worked out slowly by the actual experience of many farmers.

According to the writer, the advantages of the transplanting system are as follows:

- 1) With an economy of seed, an alfalfa is obtained which, being strong and vigorous, at once takes possession of the soil and does not suffer, the first year, from the competition of dodder and other weeds.
- 2) When transplanted in autumn, the alfalfa occupies the ground for one season less. Thus another crop can be obtained in the rotation.
- 3) Transplanting is a sure manner of insuring inoculation.
- 4) Plants in hills may be kept cultivated and free from dodder and other weeds, so the seed raised from these plants is absolutely pure (100%).
- 5) The roots and tops of these isolated plants attain a huge size, and consequently the seed is more abundant, plumper, and heavier and is thus of greater commercial value.

433. **Experiments in Germany on the Determination and Yield of Red Clover from Various Sources** (1). — MÜLLER, KARL, in *Landwirtschaftliche Jahrbücher*, Vol. 50, Pt. 2, pp. 313-353. Berlin, December 18, 1916.

From 1913 to 1915, experiments were carried out in 6 different districts of the Grand Duchy of Baden with 4 varieties of red clover from different districts of southern and western Europe, in order to determine their agricultural value. For purposes of comparison 3 more varieties were used from

(1) See *B.*, 1916, No. 169.

In spite of hard frosts the varieties from southern Europe used in the experiments did not die in winter as they are generally supposed to do. It is therefore, probable that the plants are not killed by frost as they are said to be, but by attacks from the fungi *Glascosporium caulivorum* and *Sclerotinia trifolium*.

No concordant results were obtained from experiments carried out to establish a correlation between the resistance to cold and the dry matter in varieties of red clover immediately before a frost.

34 - *Trifolium Charrierii*. Coste, a New Natural Hybrid Clover Found in France — COSTE, H., in *Bulletin de Géographie botanique*, Year 26, (Ser. IV), Nos. 325, 326, 327, pp. 1-3. Le Mans (Sarthe), January - February, 1917.

A new natural *Trifolium* hybrid may now be added to the two already described for the French flora: *T. Bertrandi*, derived from *T. medium* × *T. rubens* (from the Upper Saone) and *T. Neyrauti*, derived from *T. medium* × *T. montanum* (from the High Pyrenees). This variety, found by M. F. CHARRIER at Savenay (Lower Loire), was identified by the author as a hybrid of *T. montanum* × *T. pratense*, and was described under the name of *T. Charrierii*. It is a perennial plant, about 30 cm. high, slightly hairy, with erect, branched stems. Its characters are intermediary between those of its parents.

35 - The Cultivation of Bersim (*Trifolium alexandrinum*) in Egypt. — See No. 462 of this Bulletin (1).

36 - The Resources of Indo-China in Oil-Yielding Plants. — BRENIER, in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 7, pp. 185-195. Paris, February 21, 1917.

M. BRENIER, Director of the Chamber of Commerce of Marseilles, gives some interesting facts concerning the resources of Indo-China in oil yielding plants.

From 1912, Germany imported 1 425 000 tons of oil-yielding seeds, whereas France, the chief importing country up to that date, only imported 219 000 tons in 1913, and England about 1 million tons. As the English oil-mills increased their producing capacity by 25 %, importations into England rose to 1 700 000 tons in 1915, but fell, in 1916, to 1 400 000 tons, still exceeding the French figures.

France has the greatest interest in finding in her colonies the raw materials necessary to the fat industry. From this point of view Indo-China offers resources of the greatest importance.

Among the plants grown, M. BRENIER mentions particularly the Chinese blow-tree (*Stillingia sebifera*), which grows in the north of Tonkin and supplies white vegetable tallow, and the wild varnish (*Rhus succedanea*), a tree cultivated in the province of Putho, whose seeds supply Japan with green vegetable tallow.

Amongst other trees capable of supplying raw material, though in small quantities only, may be mentioned; Mast-wood (*Calophyllum Ino-*

(1) See also B., January 1917, No. 33.

(E4.)

phyllum), in Cochinchina; a species of *Mahua* (*Bassia* sp.) in North Annam; *Camellia drupifera* in the same district and in Tonkin; *Garcinia tonkinensis* a native of Indochina; soap-nut (*Sapindus Mukerosei*).

"Abrasin" (*Aleurites montana* or *A. Jordii*) should also be mentioned on account of the drying properties of its oil, which is superior to that of linseed, and because it is well adapted to village plantations in Central Tonkin.

The most interesting cultivated plants are: the cotton plant, *Hevea*, soya bean, castor oil plant, sesame, pea-nut, and coconut.

The cotton plant is cultivated in Indochina in the north of Annam and in the province of Thanh Hoa, where the large population supplies abundant labour for the harvest. Large cotton-fields are situated at Cambodge on the banks of the Kompong-Cham. Their produce, from 3 000 to 5 000 tons according to the year, is bought by Japan. The Lancashire mill use 500 000 bales of this cotton, which the English have introduced from India. Cotton seeds have a high value in oil yield, and when this plant is cultivated more largely at Cambodge, French buyers will be able to obtain large quantities of seed.

Five million *Hevea* plants have been put down. The Imperial Institute at London pointed out long ago the value of the drying properties of *Hevea* seed oil. The ratio of the yield in kernels to seed is 50 % and the yield of oil from the kernels is 42 % (laboratory tests). This produce is a secondary resource which should not be ignored.

The oil yield of the Cambodge soya bean is superior to that of Manchurian soya although it does not exceed 18 %. The castor-oil plant is of great interest in Indo-China. It is chiefly cultivated in Tonkin and is exported to Hong-Kong and the Far East. In laboratory experiment 42 % of oil has been obtained, but by the European methods used in the few small mills of the country only 35 % is obtained. Castor oil is much in demand at the present time as a lubricant. The value of the cakes used as manure is well known. Analyses made at Saigon showed the presence of 4.75 % of nitrogen and 2.25 % of potassium.

Sesame is cultivated in Tonkin and Annam and might well be grown in Cambodge and Cochinchina. It gives a very high oil yield, sometimes as much as 50 %. Analysis shows the oil yield of Tonkin sesame to be very remarkable. The pure cultivation of sesame in Tonkin gives a yield of 9 1/4 cwt. per acre, whereas, in British India, where enormous quantities of sesame are exported, the yield from mixed cultivation is only from 4 to 4 1/2 cwt. per acre. From 1899 to 1903 the maximum annual importation of sesame into France rose to 139 000 tons.

In good years, as much as 420 000 tons of pea-nuts are imported into Marseilles; this represents about a third of the French imports of fat. Although Senegal supplies 200 000 tons, this quantity does not nearly meet the commercial demands and its further cultivation in other colonies is therefore, most desirable. Light soil, indispensable to the cultivation of the pea-nut, is found in Tonkin, Central Annam, Cochinchina and Cambodge. Experiments show the ratio of the shell to the whole seed to

equal to that of the best African varieties (32 to 24 %). As the Annamite methods of cultivation are superior to the black ones, a higher yield is obtained than in West Africa. In Africa the yield is from 20 to 29 cwt., whereas in Indo-China it is as high as 39, or, in good soil, even 49 cwt. L. BRENTER imported from Java a pea-nut, which is very easily gathered on account of the grouping of the pods round the neck. This variety does very well in Indo-China, but appears to give a lower yield in oil than the ordinary pea-nut.

The coconut-tree covers more than 24 711 acres. It is grown chiefly along the Annam coast, which, being subject to typhoons, is not the most favourable site. The coconut grows along the south coast and also in the interior of Cochinchina, where its cultivation is localised in the towns of Mytho and Bentre. The coast of the gulf of Siam, outside the typhoon zone, appears to be the most favourable district for cultivating coconuts. The natives plant the trees much too close together so that, in Annam, the yield of one tree does not exceed 23 to 25 nuts, whereas in plantations owned by Europeans, where the trees are further apart, as many as 50 to 75 are obtained. The yield in copra and in "coir" (fibre obtained from the mesocarp) of the coconut trees of Indo-China competes closely with that of coconut trees in Malaya, Ceylon, the Indian Archipelago and the Antilles. As dessication causes a loss of 50 %, distinction must be made between the green kernel and the copra in estimating the yields. If copra is valued at £2 per 220 lbs. (its actual value is double that), the gross revenue from an average of 50 nuts per tree may be calculated at £10 per acre. If an average of 70 nuts per tree is taken, the revenue will be £14. The coconut tree bears fruit for 50 years. In the Malay Peninsula 1 acre of a European plantation is valued at about £25.

837. Cultivation of the Olive Tree on the South Coast of the Crimea, Russia. — Бульфов, Е. В. (Voulov, E. V.), Калайда, Ф. К. (Kalaïda, F. K.) and Плотницкий, Г. А. (Plotnitskii G. A.) (Laboratory of the Nikitskii Botanical Garden, Ialta). Reprint from *Вестник Русской Флоры* (Russian Flora Messenger), Vol. II, No. 1, pp. 24, 9 fig. Ialta, 1916.

The climate and vegetation of the south coast of the Crimea are similar to those of the Mediterranean coast, and the favourable soil conditions make it possible to cultivate many crops giving a high yield. The cultivation of the olive goes back to ancient times, but in the 15th. century, under Tartar rule, it was completely abandoned. After the annexation of the Crimea by Russia, preference was given to the vine, and the olive orchards were not restored. At the beginning of the 19th. century attempts were made to reinstate olive cultivation, but with little success, and at the present time it is almost non-existent.

In view of the favourable climatic conditions (minimum temperature from 5 to 8° C., annual rainfall 14 1/4 inches; i. e., similar to that of other oil-producing districts), the Nikitskii Botanical Garden, founded in 1830, is making great efforts to increase the production of olives in the Crimea. To this end the Institute made a botanical examination of the different varieties of olive grown in its gardens. At present there are about 30 varie-

ties; these will be added to later by those introduced from the Caucasus and other oil-producing districts. Olive trees are distributed free of charge and the demand for them increases gradually. Whereas, a few years ago only 50 or 60 trees were distributed annually, the figure now reaches 200.

The Garden cultivates, among others, the following 3 varieties:

- 1) *Razzo I*; small olives.
- 2) *Razzo II*; larger, violet-fleshed olives.
- 3) *Carreggiola*; fairly large, brown olives.

The appended table gives the results of an analysis of the oils of these olives; they are only preliminary, and will be controlled by subsequent research on these varieties as well as on others grown in the garden.

Physical and Chemical Constants of the Oil of 3 Varieties of Olive Grown in the Nikitskii Botanical Garden.

	"Razzo I"	"Razzo II"	"Carreggiola"
Specific weight	0.9168	0.9100	0.9135
Solidification point	— 12.0° C.	— 9.5° C.	— 12.2° C.
Moisture	—	—	—
Viscosity	17.5	13.30	15.5
Free fatty acids	7.5	36.09	20.2
Saponification index	178.3	182.00	185.7

The soil and climatic conditions, the economical-agricultural conditions of the south Crimean coast, and the results of experiments already carried out, all show that this district is well suited to olive cultivation and the Nikitskii Botanical Garden is taking active steps to encourage it.

438 - **Experiments Made in the Province of Lecce, Italy, in order to Control the Unproductivity of Olive Trees.** — VALLESE, F. (Director of the Travelling Chair of Agriculture of the "Terra d'Otranto"), in *Cattedra ambulante d'Agricoltura di Terra d'Otranto. Esperimenti diretti a combattere l'improduttività degli ulivi*, Brochure of 31 pp. + plates. Lecce, 1917.

The olive plantations in the Province of Lecce, especially to the south-east of Lecce, have long suffered from "Brusca" caused by *Stictis Panizzii* (1). This disease first appeared about a century ago, then about the middle of the 19th century, and then about 20 or 30 years ago, since when it has remained. It causes more or less extensive defoliation of olive-trees of the "Ogliarola" variety, which become quite unproductive while on the contrary the "Cellina" variety remain almost immune.

The question has been studied at various times by COMES, CUBON, BRIZI and PETRI: Prof. COMES attributed the disease to the presence of gummosis and root rot and not to the parasite *Stictis Panizzii*, which he considered as merely of secondary importance. The other author considered the disease to be caused solely by the above fungus. The subject was then left in suspense without any measures having been suggested in order to avoid, or at any rate, reduce the ill effects in question.

(1) See also on p. 1505 of B. 1913, the article by Prof. F. BRACCI on *Olive Growing in Italy* (Ed.).

Unfortunately, a serious attack occurred of leaf spot ("occhio di pavone"), caused by *Cycloconium oleaginum* (1) which still further aggravated the already bad state of many of the olive plantations in the district.

In order to increase the productivity of the olives, the writer undertook two experiments: one in a plantation badly attacked by "brusca" and leaf spot, the other in a plantation solely attacked by the latter disease. The treatment, similar in both cases, consisted in manure together with mineral superphosphates, potassium sulphate and a leguminous green-manure, and spraying the leaves with copper-lime mixture in April and August.

In the first year of experiment, in spite of a visible improvement in the foliage, the olives yielded no crop, either on treated, or on control plots. On the contrary, however, in the autumn of the second year (1916), the treated olives yielded a crop much superior to that of the control olives. The crop was 42 litres of olives per tree in one of the test plots, and 69 in another, so that it not only paid for labour, manure, spraying, etc., during the two years of experiment, but left a certain margin of profit.

In addition, it was found that the treated olives gave a better oil yield than the controls.

Further, in spite of the crop yielded in 1916, the olives seem as if they will produce equally well in 1917 to judge from their vigorous condition.

In one case, after a fresh attack by *Stictis* in one of the districts previously treated, it was found that trees that had been manured and sprayed suffered much less than the others.

The appended table gives the results of the two experiments.

Results of the two experiments:

	Area in hectares (1)	Number of olive trees			Production				Yield in oil of 100 litres (2) of olives	
		"Celli- na"	"Ogli- rola"	total	of olives		of oil			
					total	per tree	total	per tree		
					litres	litres	kg	kg	kg	%
<i>Felitto plantation:</i>										
control	8 ha	—	—	501	3 528	7.041	304.066	8.616	9.4	
treated	0.63 ha	9	32	41	1 848	45.073	224.5463	12.121	13.2	
<i>Conglione plantation:</i>										
control	20 ha	—	—	887	2 912	3.282	—	—	—	
treated	1 ha	38	5	43	3 136	72.930	—	—	—	

(1) 1 hectare = 2.4721 acres. — (2) 1 litre = 2.2 gallons.

(1) See pp. 1561 and 1566 in B. 1913, the article by Prof. F. BRACCI on Olive Growing in Italy.

The account of these experiments is preceded by an introduction devoted to the discussion of the action of copper-lime sprays on the parasites of the olive. The writer agrees neither with those who attribute the fall of the leaves and the consequent unfruitfulness to *Stictis* and *Cyclomium*, nor with those who consider these fungi as epiphenomena, and in no way connected with the fall of the leaves. The writer draws the attention of the olive growers to this point: it is not only necessary to apply all the known prophylactic measures with great care to the olive trees, so as to increase their resistance to adverse conditions, but also to give them a therapeutic treatment, such as periodical sprayings with copper-lime mixture, so as to control "brusca" and leaf spot directly or indirectly, as well as other fungus parasites that attack the leaves, roots or even the flowers.

439 - The Cultivation of *Cassia auriculata* as a Source of Tannin in British India. — RANAWARA, S., and AVARAI, T., in *The Tropical Agriculturist*, Vol. XLVII, No. 6., p. 385. Peradeniya, Ceylon.

Cassia auriculata is a very well-known shrub, occurring gregariously in the low country in the dry districts near the coast of India. The leaves cured and dried furnish "Ranawara Tea", or "Matara Tea", which is used medicinally as a blood-purifier, in the cure of diabetes, and also as a laxative. The plant is known popularly as "The Tanner's Cassia", on account of the large amount of tannin in its bark. The tannin content, however, varies with the age of the shrub, which fact explains the lack of success obtained by the use of a mixture of bark collected indiscriminately from plants of all ages. With bark selected from mature plants, however, a very satisfactory tannage is obtained, especially when it is blended with other tanning materials, such as myrabs (fruits of *Terminalia* spp.). The maximum amount of tannin is extracted at temperatures almost as high as that of boiling water: at 85°-90°C. At these temperatures, MEHT obtained 22 % of tannin.

Cassia auriculata flourishes best in deep soils, though it can grow on barren and waste land. It is well worth cultivating as a tanniferous plant; and is very little trouble, for young plantations only require weeding. One of the large tann factories of Cawnpur has cultivated it to a small extent; under irrigation, (the annual rainfall being under 40 inches), *Cassia* yields in the 2nd. and 3rd. year, and in the 4th. and 5th. year, if not irrigated.

The writer recommends the cultivation of this plant in Ceylon, in the neighbourhood of tann factories.

440 - Development of Rubber Cultivation in Burma. — *The Agricultural Journal of India*, Vol. XII, Part. I, pp. 155-156. Calcutta, January, 1917.

The rules regulating grants and assessments of land for rubber cultivation in Burma have been considerably modified. A committee consisting of the Financial Commissioner of Burma and representatives of the Lower Burma Planters' Association drafted these new regulations, which were accepted by the Lieutenant-Governor and duly promulgated. Their recommendations included the following:

Land for rubber cultivation to be granted in perpetuity subject to payment of the annual land revenue assessment and the royalty on the net value of rubber produced and exported; exemption from land revenue to be granted for the first eight years of occupation; land revenue and royalty to be levied at the rate of Rs. 3 per acre and 2 per cent respectively for 20 years; grants to prescribe that one-tenth of the total area granted must be planted with rubber trees within two years of the grant, one-half within four years, and three-fourths within eight years.

The new rules affect only land granted for rubber cultivation on and after July 1st, 1916: for land granted or leased under previous rules certain abatements of royalty and land revenue assessments are allowed and owners are offered the opportunity of surrendering their land at any time in the next ten years, and of taking out a grant under the new rules.

The following table shows the area under rubber cultivation in Burma and the amount exported in the past five years:

Year	Acres	Lbs.
1911-1912	32 772	310 240
1912-1913	44 029	526 176
1913-1914	50 946	705 072
1914-1915	57 785	987 392
1915-1916	57 843	1 285 984

Experience shows that large areas in Burma are suitable for rubber cultivation, and the committee considers that an estate in full bearing should yield not less than 350 to 400 lb. of rubber per acre.

(1) — **The Production of Rubber of Uniform Colour.** — CLAYTON, BEADLE and STEVENS, Report to the Batavian Congress, translated in *Le Caoutchouc et la Gutta-Percha*, Year 13, No. 152, pp. 9032-9033. Paris, October 15, 1916 (1).

In latex there is an oxidase which brings about rapid absorption of the oxygen of the air. Certain organic substances, probably polyphenols, which it contains are thus rapidly oxidised, causing the formation of black matter which colours the rubber.

The surface of a lump of rubber is often black when the interior is not so. When such rubber is placed in the machine the black parts mingle with the pale mass of rubber, and light grey or blue stripes are formed. During the drying process the colour deepens, and the parts which were barely visible when the crepe was fresh show black or brown stripes on a pale yellow ground. Such a rubber is classed as "not uniform" by buyers, who accuse the planters of mixing two qualities of different shades. Colour is not an indication of quality and a variation in this physical property does not imply any variation in the actual quality. Manufacturers nevertheless are suspicious of variations in colour and when the colour of a rubber is not uniform, its commercial value decreases considerably.

(1) Paper reproduced in the *Bulletin économique de l'Indochine*, Year 19, No. 122, November-December 1916. (Ed.).

Three methods for obtaining rubber of an equal colour are described:

1ST METHOD: *The use of a large excess of acetic acid in coagulation.* — The latex must be collected rapidly and taken to the factory without delay. It must be coagulated immediately, using a large proportion of acetic acid (1 part titrated as glacial acid for each 300 to 400 parts of latex). The gum should be washed and made into crepe immediately, then dried rapidly by hot air, or better still, in a vacuum drying-room (vacuum bath). An excess of acid is necessary to bring about rapid coagulation and also inhibits the action of the enzyme.

2ND. METHOD: *Boiling the rubber after coagulation.* — This method, which was first practised in Ceylon, consists in boiling the fresh coagulum in order to obtain a pale crepe. The coagulum is cut into pieces the size of a fist, which are then plunged for 10 or 15 minutes into boiling water. The heat destroys the oxidase and the rubber no longer blackens when in contact with the air. Such rubber is pale, but the boiling tends to make it adhesive, and it is more difficult to dry.

3RD. METHOD: *The action of small quantities of antiseptics such as formol and sodium bisulphite before coagulation.* — The antiseptics are added to prevent the action of the enzyme. The ratio between the amount of latex and of the two above mentioned antiseptics is very small, about 1 : 500 to 1 : 1000 or even less. After their action the antiseptics are separated from the rubber when it is washed on the creping machine.

Sodium bisulphite has been said to be a bleaching agent and to damage the rubber. This is incorrect. The rubber does not bleach; the sodium bisulphite does not destroy colouring matter which has already formed, but prevents it from forming by acting on the ferment. The proportion of bisulphite used is very small as compared with that which is required to destroy a colouring matter which has already formed. It would, moreover, be unsatisfactory to use large amounts of bisulphite, because it gives rise to the same difficulties as does the boiling process after the preparation of the crepe, and would make drying difficult.

Vulcanisation experiments show that the two first methods affect the quality of the rubber; rubber prepared with an excess of acid is of inferior quality to that prepared with the minimum. The same applies to boiled rubber.

Rubber treated with bisulphite loses none of its good qualities and can hardly be distinguished from untreated rubber.

442 — **Scientific Methods of Tapping *Hevea brasiliensis* in Java.** — DE JONG, A. W. K., in *Mededeelingen van het Agricultuur Chemisch Laboratorium*, No. XIV, pp. 26, fig. 13, Buitenzorg, 1916.

Different methods of tapping were applied to one tree, and it was proved that if tapping is carried out with an interval of one day, the channel made is of insufficient depth. This would appear to account for the fact that the yield obtained by tapping every two days is only half that obtained by daily tapping.

The part of the bark tapped in a previous year has no influence on

tapping carried out next to it, but if this part of the bark is immediately under the new incision it will have a marked influence on the yield. Two incisions at the same height 5 cm. apart hardly affect each other. If one of the incisions is made at 1.5 metres and the other at 0.5 metres, there is a distinct effect which becomes more marked if the incisions are not made simultaneously, but at an hour's interval.

These experiments seem to prove that, in *Hevea*, the latex flows in a horizontal as well as in a vertical direction. The horizontal flow is less rapid.

The use of a 15 % salt solution for cleaning the channel has little influence on the flow, and the use of ordinary water none at all.

Experiments made on a number of trees of equal yield showed that the maximum latex flow occurs at 6 o'clock in the morning and not at 10 o'clock.

Further experiments proved that :

- 1) A crooked incision yields as much as a V incision the total length of whose two branches equal that of the crooked incision.
- 2) Two crooked incisions produce about 12 % more than two straight incisions.
- 3) If the incision is renewed at the end of 2 hours the bark is spared and the production increased from 7 to 10 %, but about 4 to 6 % less is obtained than by making two different incisions in one day.

443. **The Production of "Damar" Resin in the Batjan Sultanate, Moluccas.** — Koon, V. E., in *Tydschrift voor het Binnenlandsch Bestuur*, Vol. 51, Pt. 4, pp. 277-294. Batavia, 1916.

The Batjan Sultanate, which is bound by contract to the Government of the Dutch Indies, includes islands situated right in the east of the Indian Archipelago. In these islands are found trees which, either by natural secretion, or after preliminary treatment, yield the "damar" resin used in Europe in the manufacture of varnish. This "damar-poetih" or "damar-radjah" is secreted by trees of the *Agathis loranthifolia* Salisb. species. These nearly always form forests of a fairly wide area. Another variety, the "damar-radjak", is produced by *Vatica moluccana* L. (Dipterocarpaceae). A 3rd. variety of commercial value is the "damar mata-koetjing", produced by another species of the same family as yet undetermined. The natives also collect other resins in this district, but they are chiefly of local value and used in the manufacture of torches. All these trees exude "damar" naturally. Sometimes even it is found buried in the soil, where it has collected from trees which have disappeared.

Only the *Agathis* is treated artificially to stimulate the secretion of resin. The natives make an incision of 30 cm. at man's height, then another 60 cm. higher, and others the same distance apart. Care is taken only to cut half of the bark, leaving the rest intact. The "damar" flows slowly from the incisions and, after some months, large balls of yellow, very clear resin form. The "damar" thus collected has a greater value than that scraped from the bark, in which are always found bits of the bark and other impurities. After the resin has been collected the wounds are cleaned and scraped, and, after 1 1/2 months, there is a new flow.

The process is repeated annually. Sometimes, however, the natives cut down the tree so as to have a single more abundant harvest. This has led to the devastation of the forests, and the Government is using all the means in its power to stop a custom which, in a few year's time, would totally destroy all produce. Measures have been taken to preserve the full-grown trees and to replant the devastated forests.

The natives transport the "damar" to the coast, where traders sort it according to colour, purity and transparency. It is further divided into hard and soft resins and large pieces. Thus sorted, it is packed in bamboo baskets covered with cotton sacking.

444 - Influence of Manganese on the Nitrogen Content of Sugar Beets; Experiments in Germany. — ULRICH, K., in *Blätter für Rübenbau*, Year 24, N° 3, pp. 31-33. Berlin, February 15, 1917.

An experimental field was prepared in the usual way, except that it received no preparatory manuring. It was divided into 4 plots which afterwards received the following quantities of fertiliser per hectare :

Plot 1.	150 kg. of manganese sulphate + 200 kg. aluminium sulphate.
Plot 2.	150 kg. of manganese peroxide.
Plot 3.	48 kg. of manganese phosphate.
Plot 4.	No manure.

The preceding crop was autumn wheat. The fertilising expenses were fairly high, viz. 191.5 marks (1) per hectare for the 1st plot, 270 marks, for the 2nd., and 432 marks for the 3rd.

If such manuring is to be worth while it should result in a considerable increase in the crop. The writer gave these amounts as they had given excellent results in a previous experiment. It is his intention to repeat the experiments later on with smaller amounts.

Sowing was carried out on the 28th. April, 1916, and thinning on the 6th. May following. The seed used was "Klein-Wanzlebener Original". During the growth period the rainfall was 235 mm. For various reasons the crop was lifted on the 29th. September when the beets fertilised with manganese were still at the height of their development. Those treated with manganese phosphate remained somewhat sick and gave the impression of having been poisoned by the large quantities of manganese. In all three cases, the manganese seemed to favour the leaf development and so retarded the beets coming to maturity.

Table I gives the yield of the roots in sugar.

TABLE I. — Yield of roots and sugar.

	Roots per hectare	Sugar content	Sugar per hectare
Plot 1.	31 600 kg.	15.6 %	4 800 kg.
Plot 2.	30 000	15.7	4 730
Plot 3.	23 800	16.0	3 800
Plot 4.	26 800	16.2	4 348

(1) For the purpose of this article 1 Mark may be regarded as equal to a shilling. (F. d.)

The chemical analysis of the roots and leaves is given in Table II. It shows that the manuring with manganese has markedly increased the total nitrogen content, the ammoniacal nitrogen and amides, but not the protein nitrogen.

CONCLUSIONS. — 1) Manganese sulphate at the rate of 150 kg. per hectare in company with aluminium sulphate does not poison the beets but retards their coming to maturity.

2) Manganese peroxide is not toxic when employed by itself at the rate of 150 kg. per hectare.

3) Manganese phosphate employed alone at the rate of 48 kg. per hectare has exhibited a toxic effect.

TABLE II. — Percentage Analysis of Roots and Leaves.

Plots and fertiliser	Dry matter		Ash		Polarisation (writer's own method)	Total Nitrogen		Protein		Ammoniacal nitrogen, and amides		Injurious nitrogen		Total invert Sugar
	Roots	Leaves	Roots	Leaves		Roots	Leaves	Roots	Leaves	Roots	Leaves	Roots	Leaves	
1) Manganese sulphate + aluminium sulphate	27.81	9.29	0.737	2.38	15.6	0.175	0.203	0.080	0.105	0.019	0.015	0.076	0.063	1.33
2) Manganese peroxide	22.05	9.52	0.711	2.23	15.7	0.151	0.206	0.070	0.115	0.020	0.012	0.061	0.079	1.48
3) Manganese phosphate . .	22.21	9.41	0.712	2.34	16.0	0.174	0.182	0.078	0.110	0.017	0.009	0.079	0.063	1.72
4) Without manure	22.40	9.26	0.666	2.47	16.2	0.161	0.172	0.076	0.103	0.012	0.007	0.073	0.062	1.38

445 - Experiments on the Cultivation of Mild Yellow Tobaccos in Tripoli. — MAZZOCCHI-ALEMANNI, NALLO (of the Royal Agricultural Office of Tripoli), in *Ministero delle Colonie, Ufficio economico, Bollettino di Informazioni*, Year IV, No. 7-8, pp. 302-348, 13 fig. Rome, July-September, 1916.

These experiments were carried out in the oasis of Tripoli with the following varieties of tobacco: Turkish, "Virginia Bright", Java. The seeds were obtained from the Scafati Tobacco Experimental Institute, in the province of Salerno, and from the Tobacco Agency of Lecce (Apulia). The experiments for each variety included those on:

1) *Sowing*

a) The most favourable season

b) The best type of soil

c) The best methods for combating unfavourable environmental conditions.

2) *Cultivation*

a) Manuring

b) Treatment of the soil

c) Special cultural methods.

3) *The best methods for treating the products (curing and drying).*

The following conclusions were reached :

1) *Sowing technique* : Sowing should be carried out in soils with a southern exposure, protected from winds from the 1st. and 4th. quadrants, in a semi-cold bed, with as early seeds as possible.

2) *Preparation of the Soil* : A couple of ploughings or hoeing in winter ; manure made up of 6 tons of dung and from 4 to 4 3/4 cwt. of wood-ash per acre ; usual treatment of the soil in spring.

3) *Transplanting* : This should be carried out when the plants are from 12 to 15 cm. high.

4) *Cultivation Methods* : Irrigation ; tillage ; hoeing ; hilling up ; screening against wind ; topping (for the Samsun and Porsucian varieties only) ; removal of buds.

5) *Harvesting.*

6) *Curing and drying of the leaves.*

The yields (in dried leaves) obtained are given in the following table.

Results of Experiments in the Cultivation of Tobacco in the Oasis of Tripoli.

Varieties	Yield in leaves per acre	Classes (approximate percentages)			
		1st and 2nd.	3rd	4th	Waste
Samsun	1026 lbs.	42 0/100	30 %	13 %	about 12 3/4
Herzegovina	2980	29	46	15	
Virginia	2498	85	10	—	
Xanti	830	86	10	—	
Aya	928	78	12	—	
Porsucian	820	72	15	—	
Samsun 2.	1365	60	25	—	about 12 3/4
Java	1338	85	—	3	

Further experiments were made in 6 native tobacco fields, amongst which Samsun plants were distributed. They yielded from 12 to 20 leaves per plant.

446 - *The Manuring of Tobacco Nurseries in Java.* — ULTER, A. J., in *Mededeeling van het Besoekisch Proefstation*, No. 23, pp. 11-20. Soerabaja, 1916.

On the Besoeki estate (east of Java), the tobacco nurseries are situated almost exclusively on unirrigated soil. A great part of the richness of these soils is lost by continual cultivation and must be replaced by either a green or a chemical manure.

With regard to *green manures*, experiments made with a species of *Dolichos* and *Crotalaria striata* show the difficulty of burying these plants to a sufficient depth. The leaves of the plants also appear to shelter insects harmful to tobacco, such as *Opaltrum depressum*. The use of *Centrosema*

lunieri is advised as it appears to be more resistant to the great drought these countries. Attention is also drawn to *Desmodium gyroides* and *navalia ensiformis*, plants which should give good results on account of their rapid growth.

So far as chemical manures are concerned, experiments showed the favourable action of a fertiliser composed of 60 gr. of ammonium sulphate + 20 gr. of double superphosphate, which was used over an area of about square yards of the nursery.

17 — **The Cultivation of *Chenopodium Quinoa* in Germany.** — ZEELE, in *Deutsche Schlacht- und Viehhof-Zeitung*, Year 17, No. 10, pp. 74-75. Berlin, March 7, 1917.

Chenopodium Quinoa (1) has been imported from South America into Germany, where it is now cultivated. This annual (cultivated in the Coralleras up to a height of 10 000 feet) develops in 4 months. It is remarkable for its high yield of seeds, which contain about 23 % of albuminoids and about 57 % of N. free extract. These seeds may be used either for bread-making or as a food for cattle and poultry. The green parts of the plant may be prepared and used as a vegetable in a similar way to spinach.

Cultivation experiments carried out in Germany show that *Chenopodium quinoa* grows very well there. In 1916, the "Kriegsernährungsamt" Department for the distribution of food during the war) bought the greater part of the harvest so as to prevent the use of good seed as food.

Sowing is carried out at the end of April in cold beds. To ensure a good harvest sowing should be thin and care should be taken that the seeds are not covered with too thick a layer of soil which would prevent their germinating. The plants are thinned between the 20th. and 30th. May, then planted in the open sufficiently far apart to ensure sufficient air and light. Under these conditions they may reach a height of 6 ½ ft. or more. A field of 2 ½ acres requires 7 oz. of seed. The unit yield in seed of *C. Quinoa* about corresponds to that of the cereals cultivated in Germany.

18 — **Statistics of Fruits in the Principal Countries.** — RUDDIMANN, H. D., in *United States Department of Agriculture, Bulletin*, No. 483, 40 pp. Washington, D. C., February 14, 1917.

The above-mentioned bulletin presents in a concise form statistics of nut and fruit products (oil, wine) in the principal producing, exporting and consuming countries. The figures used have been taken from official sources, usually from publications of the countries treated. The data concerning the fruit trade are as a rule fairly complete, those relating to production on the other hand, are in many instances either fragmentary, or limited to census years.

The statistics, for the most part, deal with the period which has elapsed between 1909 and the present day. The data refer to the following countries, fruits, and fruit products:

United States: Apples — Peaches and Nectarines — Plums and Prunes — Pears — Cherries — Citrus Fruits — Figs — Pineapples — Olives —

(1) See also: *B.* 1914, No. 428. — *B.* 1916, No. 59.

(Ed.)

Grapes — Strawberries — Raspberries and Loganberries — Cane Fruits — Dried Fruits — Wines — Cider — Vinegar.

Canada, Central America, British West Indies, Cuba, Dominican Republic, Paraguay, Uruguay, Austria-Hungary, Belgium, Netherlands, Denmark, Norway, Sweden, France: Olives — Peaches — Apricots — Apples and Pears for table use and for cider and perry-making — Cherries — Prunes — Wines.

Germany: Apples — Pears — Plums — Cherries — Apricots — Peaches — Wines.

Italy: Grapes and Wines — Olives and Oil — Other Fruits.

Russia, Bulgaria, Greece, Crete, Rumania, Serbia, Turkey, Spain, Portugal, United Kingdom, Japan, Persia, Algeria, Tunis, South African Union, Australia, New Zealand, Hawaii.

449 - Little Known Brazilian Fruits which are of Interest to Fruit Growers. — DORSE P. H., SHAMEL, A. D., and POPENHOF WILSON in United States Department of Agriculture Bulletin No. 445. 35 pp. 1 fig. + XXIV Plates. Washington, February 10, 1917.

Observations made during a botanical expedition of which the purpose was the special study of the navel orange in the province of Bahia where this variety is indigenous (1).

Amongst the most interesting fruits grown in Bahia in the neighbourhood of Rio Janeiro, on the plateaus and the semi-arid regions Minas-Geraes and Bahia, the writers record:

I. — BAHIA.

1) CULTIVATED FRUITS:

Tamarindus indica — "Carambola" (*Averrhoa carambola* L.) — "Groselha" (*Physalis peruviana* L.) Skeels) — "Abacate" (*Persea americana* Mill.) — "Caja" (*Spondias lutea* L.) *Caja manga* (*S. cytherea* Sonnerat) — "Sapoti" (*Achras sapota* L.) — "Maracujá's" (*Passiflora* spp.) — "Jambo" (*Caryophyllus jambos* [L.] Stokes) — "Mamão" (*Carica papaya* L.) — "Guava" (*Psidium guajava* L.) — "Araça do Rio" and "Araça cação" (*Psidium* spp.) — "Abacaxi" or "Ananasso" fruits justly prized for their flavour — "Jaca" (*Artocarpus integrifolius* [Thunb.] L. f.) — "Fruta de pão" (*Artocarpus communis* L.) — "Fruta de Conde" (*Artocarpus squamosa* L.) — "Araticum" (*Annona satzmanni* A. D. C.).

2) WILD FRUITS ESPECIALLY INTERESTING TO FRUIT GROWERS. "Gumixana" or "Gumichana" (*Eugenia Dombeyi* [Spreng] Skeels) = *Eugenia brasiliensis* Lam. — "Pitum" (*Eugenia Hischnathiana* Berg.) — "Genipapo" (*Genipa americana* L.) — "Gravatá" (*Genipa* sp.) — "Abiu" (*Pouteria Caimilo* [R. and P.] Radlk.) — "Pitanga" (*Eugenia uniflora* L.) — "Cashew" or "Caju" (*Anacardium occidentale* L.) — "Mango" (*Mangifera indica* L.) — "Dende" (*Elaeis guineensis* Jacq.).

II. — RIO JANEIRO AND NEIGHBOURHOOD.

CULTIVATED FRUITS:

"Jaboticaba" (*Myrciaria cauliflora*, *M. trunciflora* *M. jaboticaba* — "Cabeluda" (*Eugenia Phylloclady* [tomentosa] Cambess.) — "Gumiroba" (*Campomanesia Fenzlana* [Berg.] Gl.) — "Cambica" (*Myrciaria plicata-costata* Berg. = *M. edulis* [Willd.] Skeels. — "Bacuri" (*Rhedia brasiliensis* Planch. and Triana) — "Fruta de condessa" (*Rollinia deliciosa* Sal).

III. — PLATEAUX AND SEMI-ARID REGIONS OF MINAS-GERAES AND BAHIA.

Wild fruits (some cultivated).

"Pera do campo" or "Cabacinha do campo" (*Eugenia Klotschiana* Berg.) — "I. do matto" (*Rhedia edulis* Planch. and Triana) — "Pinha" (*Annona squamosa* L.) — "Cum do brejo" (*Annona spinescens* Mart.) — "Imbá" (*Spondias tuberosa* Arruda) especially interesting as a drought resistant plant — "Juvazeiro" or "Juazeiro" (*Zizyphus Juazeiro* M.).

(1) See B. January 1916, No. 67.

50 - Apples; Production Estimates and Important Commercial Districts and Varieties. — GOULD, H. R., and ANDREWS, F., in *United States Department of Agriculture, Bulletin*, No. 485, pp. 1-48. Washington, D. C., January 20, 1917.

From a study, made in 1910, of nursery catalogues issued for that year, it appeared that the nurserymen of the United States were then offering to the trade trees of at least 500 different varieties of apples. Since that date there has been a decrease rather than an increase in the varieties cultivated, and their number is relatively small.

The chief aim of the statistics contained in this paper is to determine the relative distribution of the principal varieties of apples cultivated in the United States. Table I gives data showing the actual production and the relative percentage to the entire crop of the 35 chief varieties grown.

TABLE I. — *Estimated average production of 35 of the most important varieties of apples, showing the percentage relation of each variety to the entire crop, for the years 1909 to 1913 inclusive.*

Varieties	Production in Barrels	Relation to total crop Percentage
White Permain (White Winter Permain)	269 000	0.5 %
Arkansas (Mammoth Black Twig)	393 000	0.7
Missouri (Missouri Pippin)	499 000	0.8
Wolf River	503 000	0.9
Arkansas Black	526 000	0.9
MacIntosh (MacIntosh Red)	530 000	0.9
Horse (Yellow Horse)	545 000	0.9
Northwestern	553 000	0.9
Tolman (Tolman Sweet)	592 000	1.0
Gravenstein	619 000	1.1
Fameuse (Snow)	775 000	1.3
Tompkins King (King of Tompkins County)	797 000	1.4
Golden Russet	830 000	1.4
Yellow Bellflower	845 000	1.4
Yellow Transparent	893 000	1.5
Stayman Winesap	907 000	1.5
Red June (Carolina Red June)	914 000	1.6
Lambertwig (Red Lambertwig)	915 000	1.6
Gano	927 000	1.6
Yellow Newtown (Albemarle; Newtown Pippin)	968 000	1.6
Fall Pippin	988 000	1.7
Oldenburg (Duchess or Oldenburg)	1 097 000	1.9
Red Astrachan	1 120 000	1.9
Maiden Blush	1 203 000	2.0
York Imperial (Johnson Fine Winter)	1 262 000	2.1
Grimes (Grimes Golden)	1 294 000	2.2
Wealthy	1 322 000	2.2
Early Harvest (Prince's Harvest)	1 641 000	2.8
Rome Beauty	1 813 000	3.1
Jonathan	2 135 000	3.6
Rhode Island Greening (Greening)	2 767 000	4.7
Winesap	3 012 000	5.1
Northern Spy	3 570 000	6.1
Ben Davis	7 833 000	13.3
Baldwin	7 861 000	13.4
Other varieties	6 109 000	10.4
Total	58 827 000	100.0

It is seen that the two varieties Ben Davis and Baldwin represent 26.7 % of the total production, and 8 varieties represent more than 50 %. The geographical distribution among the States of these 8 varieties is given in Table II.

TABLE II. — *Distribution among the States of the 8 leading varieties.*

<i>Baldwin</i>	Production in bushels	<i>Winesap</i>	Production in bushels
New York	9 071 000	Virginia	1 888 000
Pennsylvania	2 351 000	Kentucky	988 000
Michigan	1 868 000	Missouri	765 000
Maine	1 545 000	Tennessee	720 000
Ohio	1 394 000	North Carolina	639 000
Massachusetts	1 360 000	Kansas	605 000
Connecticut	805 000	Other States	3 431 000
New-Hampshire	780 000		
New-Jersey	504 000	<i>Jonathan</i>	
Other States	3 905 000	Missouri	1 170 000
		Washington	733 000
<i>Northern Spy</i>		Kansas	545 000
New York	3 797 000	Illinois	520 000
Michigan	1 966 000	Colorado	518 000
Pennsylvania	1 506 000	Iowa	516 000
Ohio	688 000	Other States	2 393 000
Other States	2 754 000		
		<i>Rhode Island Greening</i>	
<i>Ben Davis</i>		New York	4 289 000
Missouri	3 849 000	Pennsylvania	727 000
Illinois	2 151 000	Michigan	593 000
Arkansas	1 508 000	Ohio	509 000
New York	1 440 000	Other States	2 182 000
Indiana	1 248 000		
Ohio	1 242 000	<i>Rome Beauty</i>	
Kentucky	1 185 000	West Virginia	1 138 000
Virginia	1 040 000	Ohio	965 000
West Virginia	955 000	Kentucky	677 000
Michigan	934 000	Washington	648 000
Pennsylvania	793 000	Other States	2 011 000
Kansas	766 000		
Iowa	761 000	<i>Wealthy</i>	
Colorado	745 000	Iowa	621 000
Tennessee	623 000	New York	522 000
Nebraska	572 000	Other States	2 824 000
Other States	3 675 000		

The statistics given also include the distribution in each State of the 35 above mentioned varieties, and the distribution of early and late varieties and their respective production.

11 - **On the Growth of the Fig Tree in Arizona, U. S. A.** — LAWRENCE, W. H., in *University of Arizona, Agricultural Experiment Station, Bulletin No. 77*, 43 pp., 14 fig. + plates. Tucson Arizona, June 1, 1916.

This Bulletin contains the collected results of a general inspection of the fig-tree plantations in Arizona, carried out by the writer, both personally and by letter. The writer wished to: 1) determine the general distribution in the State; 2) find the healthy forms that have given the best results for ten years or so after planting; 3) determine the number of groups represented in the State, as well as the necessary cultural methods.

The results are also given of three years' study on 60 trees representing 43 kinds belonging to 5 botanical varieties, a work carried out in order to determine the best varieties from the point of view of the production of more uniform and abundant fruit.

In 1910, there were 3848 fig trees in bearing which gave a total crop of 57 643 kg. (being equal to about 15 kg. per tree) and 47 208 trees not yet in bearing. Practically the whole number is to be found in Maricopa county. The production varies greatly, being from 0.82 to 130 kg. per tree.

Of the 43 kinds studied, those that were the best as regards development were: Black Smyrna, Lot Injir, Bellona, Bulletin Smyrna. The following were healthy and good croppers: Mission, Lot Injir, Bulletin Smyrna, White Adriatic, Black Smyrna.

The 43 kinds belong to the following five botanical varieties:

- 1) Capri (*Ficus Carica* var. *sylvestris*).
- 2) Smyrna (*F. Carica* var. *smyrnica*).
- 3) San Pedro (*F. Carica* var. *intermedia*).
- 4) Comune or Adriatica (*F. Carica* var. *hortensis*).
- 5) Cordelia (*F. Carica* var. *relicta*).

32 - **The Yield of Unpruned Vines.** — DALMASSO, G., in *La Rivista di Viticoltura, Enologia ed Agraria*, Year 23, No. 4, pp. 49-50. Conegliano, February 15, 1917. — H. RAVAZ, L., in *Le Progrès agricole et viticole*, Year 34, Vol. LXVII, N° 10, pp. 221-224, Montpellier, March 11, 1917.

VINE

I. — M. DALMASSO has noticed that, in the vineyards of the Conegliano Vine Growing School, the unpruned vine-plants gave better yields than those that had been pruned. He further mentions the fact that M. RAVAZ had previously recorded the same phenomenon as having occurred in a vineyard of the National School of Agriculture at Montpellier, where unpruned vines unpruned for 10 years still continued to give a yield quite comparable to that of pruned vines.

The results of the experiments at Conegliano are summarised in the following Table.

	Riesling Italico vines	Production per vine-plant	Composition of the must Sugar	Acidity	Maturation Index
1915	Pruned	0.93 kg.	20.25 %	5.62 "°	3.60
	Unpruned	1.80	20.60	6.93	2.97
1916	Pruned	0.90	18.20	6.19	2.94
	Unpruned	1.29	17.50	5.81	3.01

According to the author, it can be assumed that the time within which pruning may be neglected is not long, since, in 1916 (as shown by the above Table), the difference in favour of the unpruned vines is still less than in 1915. This makes it probable that the fertility of the fruit bud is, beyond a certain limit, inversely proportional to their number.

There is no danger in neglecting to prune in winter for one or two years.

II. — M. RAVAZ quotes the experiments of M. DALMASSO, compare them with his own and then adds some personal conclusions which complete those of the latter author.

It should be remembered that as pruning is done to reduce the yield of the plants so that the quantity produced has a certain value, it is, therefore, more necessary in regions producing wines with high alcohol content than in those producing ordinary wines. If the "Pinots" of Champagne and Burgundy, the "Chenins" of the Loire, the "Cabernets", "Merlots" and "Malbecs" of the Gironde, the "Carignans" and "Grenaches" of Roussillon, the "Muscats" of Lunel and Frontignan, etc., were not pruned, there would be a large crop of rather small grapes with small seeds and which would not easily ripen, thus producing but a mediocre wine.

Where varieties with large grapes and seeds are grown, the reduction of the number of grapes by pruning is in some measure compensated for by the individual increase in size. Thus, there is not the same difference in yield, and consequently in quality, between pruned and unpruned vines as in the preceding cases. This is what took place with the Aramon variety which the writer used for his observations.

There is no reason to believe that it is fatal if pruning is not carried out (as has frequently happened during the war), especially in regions producing ordinary wines; it even presents an advantage as giving easier defence against mildew, which is all the less dangerous when attacking more slowly growing branches.

453 - Stocks Tested at the National School of Agriculture, Montpellier, France. — RAVAZ, L., in *Le Progrès agricole et viticole*, Year 34, No. 8, pp. 176-178. Montpellier, February 25, 1917.

An experimental field was planted with stocks 16 years ago at the National School of Agriculture at Montpellier. The soil contained 25 to 3 per cent. of calcium carbonate, but it was only slightly liable to cause chlorosis. Riparia did not do very well there, but it did not succumb to chlorosis. It was pulled up some years ago, as well as certain other varieties in order to make room for new plantations.

7605, 4206 are Riparia-Berlandieris, with satisfactory foliage; 301 17-37, 7821, 219-A, 20031, 20035 are Rupestris-Berlandieris whose foliage is, on the whole, better than the previous ones. 17-37, which is well liked in Sicily, does finely.

Average weight (in kg) of branches per stock of various grafting varieties.

Stocks	Aramon	Servant vert	Dattier	Muscad de Hambourg	Muscad d'Alexandrie	Servant rond	Gros Colmar	Vulney blanc
Plot I. — Side A.								
1.	0.700	0.850	0.800	1.425	0.825	1.250	1.700	—
A.	1.025	0.775	1.050	1.050	0.700	1.050	1.700	—
4-153.	1.100	0.850	1.325	1.100	0.825	1.500	1.250	—
4-152.	0.450	0.425	1.450	0.375	0.325	1.200	1.250	—
U.	1.400	0.975	0.725	0.600	0.875	0.800	1.550	—
9.	0.650	0.650	0.450	0.550	0.500	0.950	1.400	—
9.	1.125	0.550	1.050	0.800	0.375	1.300	1.150	—
andieri Gigantesque N° 2.	0.700	0.650	1.025	0.550	0.475	1.000	0.850	—
andieri Gigantesque N° 19.	0.650	0.975	0.600	0.800	0.500	1.000	1.450	—
andieri Gigantesque N° 20.	1.175	0.600	1.100	0.150	0.400	—	0.950	—
andieri Gigantesque N° 20.	0.500	0.900	0.750	0.625	0.450	0.750	0.950	—
andieri Gigantesque N° 20.	0.850	0.500	0.350	0.350	0.325	—	0.750	—
4.	1.400	1.050	1.525	1.125	0.600	0.450	1.100	—
15.	0.650	0.750	1.550	0.800	0.425	1.100	1.000	—
radio Jardin.	0.550	0.600	0.800	0.825	0.475	0.750	0.750	—
lfolia Rupestris.	1.050	0.600	0.550	0.750	—	0.250	1.200	—
lfolia Rupestris.	0.500	0.775	1.025	0.800	0.900	0.650	0.250	—
lfolia Rupestris Jardin.	0.725	0.550	0.650	0.725	0.500	0.300	0.650	—
4.	0.525	0.580	1.000	0.550	0.650	0.900	1.600	—
1.	0.775	0.500	0.600	0.550	0.400	—	0.250	—
1.	1.050	1.400	0.350	0.825	0.475	1.100	1.150	—
lria Rupestris B.	0.700	0.600	0.900	0.375	0.425	—	0.800	—
pez.	0.300	0.600	1.050	0.550	0.300	0.200	0.300	—
1.	1.425	0.915	0.800	1.150	1.200	1.100	0.300	—
non Rupestris Berlandieri 9.	0.500	—	—	0.650	0.900	—	0.700	—
non Rupestris Berlandieri 15.	1.075	1.000	1.400	0.740	0.225	0.300	1.300	—
Plot I. — Side B.								
andieri X Riparia.	0.475	0.850	0.825	0.400	0.250	1.100	1.350	1.100
C.	0.600	0.625	0.625	1.200	0.100	0.700	0.250	1.250
12-152.	0.525	0.825	1.050	0.600	0.650	0.750	0.600	—
A.	1.125	1.075	0.950	0.600	1.000	0.550	0.400	1.450
C.	0.825	—	0.500	1.000	0.325	0.550	1.400	0.800
1.	0.875	0.800	0.600	0.600	0.375	1.050	1.250	0.500
5.	1.300	0.575	1.150	0.700	1.000	1.000	—	0.900
andieri Gigantesque N° 3.	0.675	0.800	—	1.350	0.400	—	0.650	1.100
andieri Gigantesque N° 18.	1.500	0.850	1.050	0.450	0.975	—	1.300	—
5.	0.700	0.575	—	—	0.700	0.350	0.400	—
5.	0.900	1.200	1.650	0.600	0.375	0.700	1.100	1.300
1.	—	0.550	0.300	1.200	0.500	0.700	1.000	—
1.	1.025	1.100	0.300	0.650	0.525	0.600	1.600	—
1.	0.550	0.675	0.475	—	0.300	0.500	—	0.800
or Narbonne.	1.500	0.675	0.525	—	0.500	—	0.750	0.800
ria Indica.	1.050	0.750	0.515	—	0.700	0.450	0.650	1.150
1.	—	1.000	0.700	0.450	0.500	0.750	0.350	0.850
1.	1.025	1.000	1.250	0.700	0.250	0.450	—	0.800
14.	0.950	1.200	0.550	0.850	0.250	0.300	0.900	—
1.	1.250	0.650	1.225	1.400	1.000	0.400	0.800	0.750
1.	1.325	1.700	1.600	0.450	0.350	—	1.700	—
1.	1.000	0.850	0.525	—	0.450	0.250	1.100	0.050
1.	0.500	0.500	—	—	—	—	—	—
1.	1.400	0.550	0.100	0.550	0.675	—	—	0.850
mon X Rupestris Berlandieri N° 15.	0.800	0.550	1.150	0.650	1.200	1.200	0.950	1.000
5.	0.850	1.100	—	0.600	0.900	—	1.250	—

It is one of the best crosses in this group. It also seems to be drought resistant, at any rate in Sicily. Unfortunately, it is difficult to propagate by cuttings. 219-A and 20029 have more or less come up to expectation. All these numbers are derived from a cross between Vinifera-Berlandieri and a Rupestris; they are probably inferior, at least as regards strength and resistance to chlorosis, to the new varieties produced from Rupestris du Lot.

There is nothing to remark about the Berlandieri \times Gigantesque Nos. 2, 19, 20, 5, and 18.

In the following group, up to and including Colorado-Jardin and 683, which is more or less related to V.-Monticola, the only number worth notice is 18804. In that vine, Riparia dominates, and Monticola shows up very little. All the same it is vigorous and is worth testing on a large scale. 1-R. and 2-R., very pure Riparia-Monticolas were obtained by the writer; they do not show up very well because of the bramble-leaf disease. But elsewhere, in a more chlorotic calcareous soil, they are clearly more resistant to chlorosis than 420-A. The writer thinks that crosses of Rupestris du Lot and V.-Monticola would be better than Rupestris-Berlandieri. But these new hybrids are not obtainable commercially.

Cordifolia-Rupestris, 107-11, Taylor-Narbonne, Rip.-T.-Indien, 125, are rather weak, partly because they are very sensitive to lime. Taylor-Narbonne and 11-F are weakened by phylloxera.

In the Riparia-Rupestris group, 3306, 3309, and 3901, hold the best place; 101-14 is much weaker. Herbeumont and Jacquez are very feeble because of the phylloxera.

333 and 41-B, Vinifera-Berlandieri hybrids, are both very good, and have not suffered from phylloxera. These two vines might be suspected on account of their origin, but continued experiments show they are all right. In comparative pot tests of phylloxera resistance, 41-B was always resistant, and 333 less so. In the open field, both seemed equally resistant. They can therefore be used in all vineyards where they are required because of calcareous soil.

The Aramons-Rupestris-Berlandieri of MALÉGUE are $\frac{1}{2}$ Berlandieri and $\frac{1}{4}$ Vinifera. They should be sufficiently resistant to phylloxera. In the above-mentioned tests, they were slightly affected by phylloxera, but they had superficial lesions. In the experimental field their roots were healthy and the foliage of one of them, No. 15, or 150-15, was very satisfactory.

454 - *Pinus ponderosa* Laws in Oregon, United States. — MUNGER, THORNTON, in United States Department of Agriculture, Bulletin, No. 418, 48 pp. Washington, D. C. February 6, 1917.

Pinus ponderosa Laws is known throughout its range simply as pine or yellow pine, and in the lumber trade of the northwest, as western pine. It is sometimes called western soft pine, or more rarely, Oregon white pine. In California, it is commonly termed western white pine, and California white pine.

This conifer is the most widely distributed pine in the United States.

occurring in 12 States, and is one of the most valuable trees. In Oregon, *P. ponderosa* occurs on about 14 000 000 acres; the estimated stand amounting to 70 000 000 000 ft.

The altitudes at which it is found, range from the lowest zone of forest growth up to 6000 ft. on the slopes of the mountains; scattered individual trees even growing as high as 8000 ft. It flourishes best in the heat and dryness of a continental climate. In the north, or on the highest slopes, its development is poorer than where the summers are long and warm. This pine forms splendid forests where the precipitation is only 18 inches a year; it also does well where the rainfall is much heavier — 40 inches or more — but its development is by no means proportionately better in the wetter climates: it prefers well-drained soils.

Pinus ponderosa is a large well-formed timber tree with a straight bole and round crown. It is well cleared of dead branches, but usually clothed with live branches from $\frac{1}{4}$ to $\frac{1}{2}$ its height. The foliage is not extremely heavy; the needles, which are borne in clusters of 3, are usually from 4 to 6 inches long; on the best soils, they attain the length of 11 inches.

This tree is intolerant of shade; seedlings do fairly well under the shade of parent-trees, but saplings do not grow thriftily until they receive direct light.

Pinus ponderosa rarely produces any cones before it is 50 years old, and large crops are not borne except by very much older trees. Every three years and sometimes oftener, come good seed years. The number of seeds to the pound is between 8 000 and 9 000; one bushel of cones will yield 1 $\frac{1}{2}$ lbs. of seed. The seed germinates fairly freely, but the mortality of the seedlings is high (79 per cent); hardly one tree in a hundred lives to be 2 years old.

The tree grows slowly till it is 20 or 30 years old; at 6 years of age, it is never more than 1 ft. high; when 20 years old, it attains the height of 4 ft. Only those seedlings ultimately survive which grow between clumps of old trees, or beneath those that have recently died. Cold, drought, fires and grazing sheep are the principal causes of the destruction of the young seedlings.

As the chief enemies of *Pinus ponderosa* the writer mentions the "pine butterfly" (*Neophasia menapia*), feeding upon the needles — the "western pine destroyer" (*Dendroctonus brevicornis*) — and the "mountain pine beetle" (*Dendroctonus monticolae*); these two latter insects kill a large number of pines.

Of the vegetable parasites, the following may be named: *Razoumofskyia campylopoda* a kind of mistletoe, which impairs the tree's value for commercial purposes. — *Peridermium filamentosum*, a rust attacking young growth — 2 lichens, *Alectoria fremontii*, "black moss", and *Evernia vulpina*. — *Polyporus schweinitzii* ("dry brown rot"), *Trametes pini* ("ring scale fungus") — *Fomes Laricis* ("sap rot"). The porcupine does little damage and birds do good by destroying harmful insects.

The high winds, which amount at times to tornadoes, in Oregon, do much harm by blowing down the trees. Most of the forests in which *P. pon-*

derosa occurs commercially are at least 75 per cent yellow pine; in the pure yellow pine forests of the State, the trees are spaced rather widely. In the Blue Mountains, *P. ponderosa* is associated with *Larix occidentalis* — *Abies concolor* — *Pseudotsuga taxifolia* (Douglas fir) — *Pinus contorta* (Lodgepole pine) — *Pinus Lambertiana* (sugar pine).

In the stands are to be found trees of all ages, from seedlings to veterans 500 years old. In the virgin stands throughout the State a very large proportion of the trees is about 225 or 275 years old; suggesting that after this age their mortality is great. In the Blue Mountains are found per acre 20 to 30 pines from 12 to 30 inches in diameter. *Pinus ponderosa* grows very slowly when young, but its growth is particularly rapid when it reaches from about 75 to 100 years of age; at 150 years of age the tree attains its normal height, and from this time, it only grows from 1 to 2 ft. every 10 years.

The following table drawn up by the writer shows the average height and diameter of these trees at various ages in 13 typical stands in Oregon.

	Age in years							
	50	100	150	200	250	300	350	400
Average height	ft	ft	ft	ft	ft	ft	ft	ft
	24	62	90	104	111	115	119	120
Average diameter at breast height	in.	in.	in.	in.	in.	in.	in.	in.
	4.7	13.2	19.3	23.4	26.6	29.4	31.1	30.9

The yellow pine grown in Oregon is used in that State for building and construction purposes. The best grades are sent to the neighbouring States, and even to the Eastern States, where the wood is used as a general all-purpose factory material. The lower grade wood is made into boxes and fruit boxes. In the district where it grows, this conifer affords excellent fuel. It is however, only the "pitchy" parts of the tree that are durable in the ground and can be used for posts, fences etc. Yellow pine wood has never been used commercially for paper-making, although experiments made by the Forest Service have proved that it would probably produce a good grade of coarse, wrapping paper. The results of the experiments carried out by the Forest Service show that it is doubtful whether sufficient good turpentine could be obtained to render turpentine profitable.

For replanting, the above-mentioned Service uses trees 2 or 3 years old, for direct seeding has not proved successful.

The Forest Service is also engaged in the management of the forests and their protection from fire; fires in yellow pine woods are comparatively easy to check.

Selection cutting is the rule, periodic cuttings are made, in each of which all the mature, or defective, trees are removed, while the saplings.

poles and young trees are left to form the basis of the next crop. Each tree to be felled is marked by an experienced woodman who selects those of greatest commercial value, and at the same time, seeks to insure the future welfare of the forest.

In the appendix, the writer gives the official instructions for marking timber and burning brushwood.

65- **The Technical Properties of the Wood of the Greek Fir (*Abies cephalonica* Link).** — JANKA, GABRIEL, in *Centralblatt für das gesamte Forstwesen*, Year 42, Parts 9 and 10, pp. 324-338, Vienna, 1916.

At the request of M. ADOLPHE STENGEL, Chief of the Austrian Forest Mission in Greece, and with the permission of the Austrian Minister of Agriculture, the writer has conducted work on the technical properties of the wood of the Greek Fir *Abies cephalonica* Link at the Forest Experiment Station at Mariabrunn. The material for the tests (28 trunk sections and 10 trunks) had been chosen on the spot by the commission and then sent to Mariabrunn. It arrived in a slightly dry state in the spring of 1914, was dried in summer and tested in autumn. It was hoped not only to obtain information as to the technical value of the wood, which had not previously been ascertained, but also to complete the tables of volume and yields in essence, found by STENGEL, to obtain facts for differentiating between the fir *Abies cephalonica* var. *Reginae Amaliae* (which occurs in Arcadia and central Peloponnesus) and the native variety occurring in the rest of Greece (except Cephalonia): *Abies cephalonica* var. *Apollinis*. These results could not be obtained, owing to shortage of material.

From the tabulated results of the tests, it seems that there is no difference, as regards the wood, between *Abies cephalonica* var. *Reginae Amaliae* and *Abies cephalonica* var. *Apollinis*. The wood of the Greek Fir is mostly of bad texture. On account of the lack of control in the forest, most of the trunks have branches nearly down to the ground, lesions at the foot as well as red rot, and often in the upper parts, bunches of mistletoe. The prevention of increase in height and width owing to nibbling by goats causes the formation of narrow rings inside the trunk followed by a rapid increase in height and growth when the terminal bud is sufficiently high to escape the goats.

The trunks being placed too far apart, they increase too rapidly in thickness, which results in wood with the annual rings spaced abnormally and of little strength. Besides, much red wood is produced, owing to compression, which is by no means desirable. Such fir wood cannot be used for fine cabinet work, and is moreover difficult to work. But, if the Greek pine is cultivated according to sound principles, it can produce an irreproachable wood, satisfying all technical requirements. In order to obtain this, its first development should not be hindered and it should not be thinned too early.

The following technical data were obtained by comparing the Greek fir with the ordinary white pine.

	Greek fir	Common white pine
Specific weight of air-dried wood	45.5	43.8
Absolute specific weight	41.3	40.7
Resistance to crushing	320 kg. per cc.	392 kg. per cc.
Hardness	333 kg. per cc.	338 kg. per cc.
Ratio		
Resistance to crushing	7.03	8.95
Specific weight of air-dried wood		
Ratio		
Hardness	7.32	7.72
Specific weight of air-dried wood		

The ratio between resistance to crushing and the specific weight is always lower for the Greek fir, as at present in Greece, than for white pine. The same is true for the ratio, hardness: specific weight.

The crushing resistance increases inversely to the width of the annual layers.

On the contrary, the hardness of the wood at first decreases with the increase in width of the annual layers, but afterwards increases on account of the greater amount of red wood in proportion as the annual rings increase in width.

There is a direct proportion between the resistance to crushing and the specific weight: the first increases at the same time as the second.

456 - **Forest Management in Formosa.** — *Japan Weekly Chronicle*, No. 757; reprinted in *Revue des Eaux et Forêts*, Year 15, Vol. IV, No. 1, pp. 30-31, Paris, Jan. 1, 1917.

According to a report of the British consul at Tamsui, special attention has been given of late years by the Government to the intensive management of the inland forests of the Island of Formosa.

The wood from the forests of Mount Ari has been largely utilised since 1915, when wood from the Arisan forest was first exported. About three million cubic feet are obtained annually from this forest. The most recent and improved methods are used, and the wood is sent to the Kagi timber-yard in logs.

The Kagi timber-yard is near the starting point of the Arisan railway which runs along the mountain side for a distance of 41 miles. Aerically transport cables have been fitted up which allow a yield of from 10,000 to 14,400 cubic feet per 10-hour day to be attained.

Two new forests suitable for working have been found in other parts of the island. One of these is in the Taichu prefecture, on the slopes of Mount Hassen, the other is in the Giran prefecture, in the upper reaches of the river Daidakusike near Mount Sansei.

Attempts are being made by the forestry department to develop the management of the Formosan forests to a still greater degree.

According to the latest estimates the area of the Hassen forest is half that of Mount Ari, whereas the forest in the Giran prefecture is 1½ times as big as that of Arisan.

The great transport difficulties at Arisan, where a railway had to be

built, do not seem to exist for the two new forests. In this case there are water-courses down which the logs can be sent either to the coast or to the railway.

- 457 - **The Unsuitable Working of Dammara Forests in the Sultanate of Batjan, in the Moluccas.** -- See No. 443 of this Bulletin.

LIVE STOCK AND BREEDING.

- 458 - **Auto-Inoculation and Early Development of the Larva of the Horse-Bot (*Gastrophilus intestinalis*) in the Membranes of the Mouth Cavity.** -- ROUBAUD E., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 164, No. 11, pp. 453-456. Paris, March 12, 1917.

The method by which the larvae of the Horse-bot (*Gastrophilus intestinalis* de Geer) obtain access to the alimentary canal of their host and the conditions of their early development are not yet known. According to some writers (NUMAN, BRAUER), the young larvae, after hatching, find their way to the mouth and nose of their own accord. The majority of writers consider that they obtain entry to the mouth through licking, after which they are swallowed. According to CHOLODKOVSKY the larvae, after leaving the egg, penetrate the skin of the horse, causing irritations which force the animal to rub the affected spots with his teeth, extract the larvae and swallow them. PORTSCHINSKY, on the other hand is of the opinion that only certain larvae penetrate the epidermis. They do not develop there but their irritating effect induces the horse to lick and so pick up with his tongue the other larvae which then pass directly into the alimentary canal.

According to the present writer, matters happen in totally different fashion, as may be seen from the following:

a) The eggs of the parasite do not hatch spontaneously and the early larvae may remain in the egg in the resting state for several weeks.

b) The ripe egg liberates its larvae through mechanical contact. It has been shown that a sharp knock at the anterior pole of the egg causes the operculum to spring off and instantly frees the larva, which at once escapes. A moist contact like that of the horse's tongue is not indispensable to effect emergence. Sharp rubbing against the lips or teeth fulfils the same object.

Now, it is known for certain that horses *lick themselves very rarely*; when suffering from local irritation they respond by scratching or rubbing with their mouth.

c) The larvae, freed by contact with the mucous membrane of the lips or gums, immediately penetrate the epithelium.

d) The larvae never perforate the skin. (The theory of the Russian scientists is therefore untenable).

e) The larvae make their way by developing in the mucous membranes of the mouth.

The first stage in the life-cycle of the horse-bot must consequently be read as follows: the larvae remain within the egg until some cause or another induces the horse to rub his lips against the eggs; they are then liberated, bury themselves in the epithelium in which they are caught up and make their way to the deepest parts of the mouth cavity, gradually increasing in size up till their first moult.

Infection is produced when horses scratch themselves with their teeth pretend to bite among themselves, or chase with their mouths the flies, which are worrying them. The chances of infection are considerably reduced if the parts of the body where the eggs are laid are given a light rub from time to time so as to bring about the premature hatching of the larvae.

The early evolution of the *Gyrostigma* (*Spathicera*) of the rhinoceros, owing to the close resemblance of eggs and larvae undoubtedly corresponds closely to that of *Gastrophili*. With regard to the larvae of *Gastrophilus* observed in man in the cutaneous folds of creeping myiasis, everything points to their point of ingress being the external mucous membranes of the eyelids (1) or lips, or some lesion of the skin. These larvae are incapable of having perforated the epidermis directly.

459 - **Diagnosis of Tuberculosis (Especially the Bovine Form) by Complement Fixation.** — EICHORN, A., and BLUMBERG, B., in *Journal of Agricultural Research*, Vol. VIII, No. 1 pp. 1-2. Washington, D. C. January 2, 1917.

The tuberculin test has been very useful in the diagnosis of tuberculosis, but it has the defects of being somewhat slow, difficult to apply and of easily lending itself to falsification, for animals which have been treated several times no longer react to it. In the search for other reliable means for diagnosis, other tests have been employed: ophthalmic — cutaneous — intradermal and intrapalpebral, but as a whole, they are not so reliable as the subcutaneous test when it is scrupulously carried out. Since the published results on similar investigations are very contradictory, the writers thought it well to devote their attention to the subject of establishing the value of the complement fixation test in tuberculosis.

After explaining the nature of the problem, and giving a historical summary of work so far done on the subject, the writers describe their own experiments which were carried out in the Pathological Division of the Bureau of Animal Industry of the United States Department of Agriculture.

They examined in all 958 samples of bovine serums, 120 samples of hog serums and 22 samples of human serums. The results are set forth in Table I. In order that a clearer conception might be obtained as to whether there exists any relation between the degree of reaction and the character of the disease, it was deemed advisable to separate the cases into 5 groups according to the lesions found on post mortem examination. as follows:

(1) Eggs of *G. haemorrhoidalis* have been found upon the eyelids and lashes of individuals infected with *Gastrophilus* myiasis. (Author's note).

- 1) Animals which showed no tubercular lesions and which failed to react to the tuberculin test.
- 2) Animals which showed arrested lesions, with a limited number of small, slight, geocarcareous foci confined to the lymph glands.
- 3) Animals with progressive lesions of a glandular type involving also some of the organs.
- 4) Animals with well-marked or generalised lesions.
- 5) Acute and military tuberculosis.

The reaction does not appear to be constant and the degree of the reaction seems to have no relation to the extent of the disease. The degree of fixation is also irregular since the slight positive reactions (+) do not occur proportionally with a greater frequency in mild cases than the complete fixation (+++ +). As indicated in Table I, out of 320 negative serums, a total of only 275, or 85.9 per cent., proved distinctly negative on testing; whereas of 370 positive serums 290, or 80.5 per cent., were positive, and 90 (or 7.6) were atypical. The grand total of 81.6 per cent of accurate reactions obtained is by no means sufficient to make the test practical for the control of the disease.

In order to see the comparative practical value of the method elaborated by the writers and described in their article, their antigen should be compared with those prepared by other investigators. Table II shows the results obtained by comparison with BESREKA's antigen.

Conclusions. — 1) The complement-fixation test for the diagnosis of tuberculosis in cattle is not so reliable as the subcutaneous tuberculin test.

2) Since a large proportion of the positive cases give only a faint reaction, it necessitates a very careful titration of the antigen and a most accurate observance of all the details of the technique of the case.

TABLE I. — *Summary of the Tests Conducted with Antigen Prepared from a Bacillary Emulsion and Tuberculin Precipitate.*

Bovine Serum	Total number	Degree of fixation							Percentage
		++++	+++	++	+	±	—		
Group 1: Serums from animals without tubercular lesions and negative to the tuberculin test . . .	320	3	2	10	13	17	275	85.94	
Group 2: Serum from animals showing arrested tubercular lesions	207	21	28	39	48	19	52	77.15	
Group 3: Serum from animals with progressive lesions	79	11	16	23	16	5	8	83.56	
Group 4: Serum from animals showing generalised, well marked, or extensive lesions	43	12	9	4	7	4	7	74.42	
Group 5: Serums from animals showing acute or military lesions	31	9	4	4	10	1	3	87.1	
Total . . .	680	56	59	86	90	46	345	81.63	

TABLE II. — Summary of Tests Conducted for Comparative Purposes with (I) Antigen of BESKREDA and (II) the Antigen Prepared from a Bacillary Emulsion and Tuberculin Precipitate.

Groups *	Number of cases	Degree of Fixation												Percentage	
		++++		+++		++		+		±		—			
		I	II	I	II	I	II	I	II	I	II	I	II	I	II
1	91	2	—	1	2	1	1	4	3	—	—	81	83	91.1	93.4
2	35	2	—	—	—	1	—	12	19	4	7	16	9	42.86	54.29
3	3	—	—	—	—	—	—	2	3	1	—	—	—	66.67	100
4	1	—	—	—	—	—	—	—	—	—	—	1	1	—	—
5	6	—	—	—	—	1	1	—	—	4	4	1	1	16.35	16.35
Totals . . .	136	4	—	1	2	2	2	18	25	10	11	99	94	Average 43.54	Average 64.16

* The groups are the same as in Table I.

3) The amount of fixation cannot be considered as an index of the extent of infection. Frequently, samples from animals showing arrested retrogressive lesions give a more marked fixation than animals affected with acute, progressive, generalised tuberculosis.

4) The complement-fixation test might be employed as a supplementary test in cases of doubtful or atypical reactions to the subcutaneous or other tests.

5) The subcutaneous tuberculinisation of healthy animals affects the results of the complement-fixation test. Such interference may be noted as early as the fourth day following the injection and may persist for at least 6 weeks and possibly for a much longer time.

6) There is no material difference in the reliability of the test in cattle as compared with human beings.

7) Comparative tests with various antigens proved that one prepared with bacillary emulsion and tuberculin precipitate is the most effective.

8) Antibodies do not appear to be constantly present in tuberculous animals.

460 - Anti-rinderpest Serum Preparation at the Muktesar Laboratory India. — SHILSTON, P. W. in *Agricultural Research Institute, Pusa, Bulletin*, No. 64, pp. 1-18. Calcutta 1916.

The series of observations described in this paper were carried out to ascertain the potency of sera taken 8, 12 and 16 days after the injection of virus and to compare the results with those given by sera taken 15 and 17 days after injection; the latter intervals were those allowed in the routine method of serum manufacture followed at the Muktesar Laboratory, the bleeding being taken at the rate of 6 cc. and 8 cc. per lb. body weight

respectively. The three bleedings at four days intervals were all taken at the rate of 6 cc. per lb.

Previous experience had shown that cattle would stand bleeding to this extent with little or no interference to their health and it seemed probable that the potency of the sera from the second and third bleedings would not be found to diminish as rapidly as when intervals of a week are allowed between the bleedings; the saving in time would also be a consideration. Tests were made of the potency of the mixed sera from the two series and were repeated on a large scale using both hill bulls and buffaloes for serum production.

As the main purpose of the experiments was to provide an increased yield of serum which should be at least of equal potency to that prepared by the existing routine method, records were kept of the amounts of serum obtained at each bleeding and the total yields given under the two systems were compared.

Throughout the experiments the potency of the sera was tested on susceptible hill bulls, six for each test, by injecting them simultaneously with virulent rinderpest blood (to which a solution of potassium citrate was added) and graduated quantities of the serum. In the routine serum testing, doses of 36 cc., 72 cc. and 108 cc. per 600 lb. body weight were administered, two bulls being treated simultaneously; these amounts being equivalent to 2 cc., 4 cc. and 6 cc. respectively in the case of plain animals which, on account of their low susceptibility, require eighteen times as small a dose of serum as hill bulls, the latter having an uniform high susceptibility. In order to gain a more accurate estimate of the relative values of the sera, the doses throughout the experiments were fixed at 27 cc., 54 cc. and 81 cc. per 600 lb. body weight, equal to $1\frac{1}{2}$ cc., 3 cc. and $4\frac{1}{2}$ cc. respectively for plain cattle.

At each test two hill bulls were inoculated with virulent blood alone to serve as controls; after developing symptoms of acute rinderpest these were bled to death to provide virulent blood for hyperimmunization.

The results of the above experiments showed that the interval allowed between the injection of the rinderpest blood and the first bleeding for serum in hyperimmune animals may, with advantage, be reduced to 8 days, as the immune bodies are then present in full amount. By taking three bleedings at the rate of 6 cc. per lb. body weight on the 8th., 12th. and 16th. days after injection a mixed serum was obtained of equal (hill bulls) or increased (buffaloes) potency to that obtained by taking two bleedings 15 and 17 days after injection at the rate of 6 cc. and 8 cc. per lb. body weight respectively, as was done in the routine method followed at the Muktesar Laboratory. The actual yield of serum after each injection was increased from 6.79 c.c. per lb. body weight by the two bleedings system to 9.6 cc. by the three bleedings system or an additional 2.81 cc. of serum per lb. body weight; an increase of 41.4 % on the former output.

With an average issue of over 500 000 cc. of anti-rinderpest serum per month this increase without additional expenditure represents a very large reduction in the cost of manufacture.

462 - Value of "Bersim" (Alexandrian Clover) for Feeding Stock. Experiment in Egypt. — PIOT, J. B., in *Bulletin de l'Union des Agriculteurs d'Egypte*, 14th Year No. 114, pp. 14-22, 1 diagram. Cairo, 1916.

Following the rotation of cotton soils in practice in Lower and in portion of Upper Egypt, distinction is made between "Bersim" *târiche* (improving) and "Bersim" *moustadim* (permanent).

The former immediately precedes the cotton in the rotation; it is taken off once only in the large plantations, where the soil must be prepared with all speed for receiving the cotton crop; the land is then ploughed and the remains of the crop are turned under and form a nitrogenous fertiliser. Small planters who only cultivate once or twice at close intervals for the cotton, plough as late as possible and take off as many as 2 or even 3 cuts of Bersim.

In general practice, the area sown in Bersim *târiche* is calculated so as to provide sufficient forage to feed the stock up to the time of ripening of the Bersim *moustadim*.

The sowing down of vast areas to Bersim *târiche* has induced Mr. JEFFERYS, of the Administration of Domains, to carry out tests with ensilage. This would enable a moist fodder to be prepared for the summer months and one relished by stock.

Bersim *moustadim* is generally broadcasted in fields of irrigated cotton before the final picking. In this way it reaches maturity just in time to replace the Bersim *târiche*. Usually 3 cuts are obtained, the last of which is partially preserved for seed and partially converted into *driss* or dry fodder.

Bersim is thus administered to stock in 3 forms: green, as pasture or a soiling crop; dry, as *driss* and as ensilage.

Of recent years, thanks to the remarkable improvement of vast areas more or less saturated with salt, the Administration of Domains has been able to extend considerably the area under Bersim *târiche* and *moustadim* and to obtain enormous quantities of ensiled Bersim and of *driss*. In this way, the Administration has had every facility for conducting experiments on the value of Bersim in all 3 forms for the feeding of young cattle.

In an experiment with calves (about 6 months old), green Bersim pastured or soiled, gave an increase of 68 % on the initial weight, thus proving itself to be a first class food for young stock.

Summer feeding with *driss* or ensiled Bersim has been shown to be inadequate to ensure normal development in young cattle. In 6 months it has only given an increase in live weight of 8 to 9 %. This difference appears to be paradoxical and the writer intends investigating the reason.

Additional experiments have shown that ensiled Bersim *târiche* is preferable to ensiled permanent Bersim. Permanent Bersim should therefore be reserved for preparing *driss*.

It must be concluded on the basis of the experiments that *driss* and ensiled Bersim are insufficient to ensure proper growth in calves and that

seems indispensable to supplement these fodders by a ration of bean, maize, etc., etc.

With regard to mature cattle, the experiments have shown that ensiled Bersim may suffice as a maintenance ration, when the animals are at rest, if working, a supplementary ration of beans and straw should be added.

63. **Employment of Ground-Nut Cake in the Feeding of Livestock.** — HEIM, P., in *Bulletin de l'Office Colonial*, 10th Year, No. 109, pp. 44-52. Melun, Jan. 1917.

At the present moment, the question of the utilisation of ground-nut cake (which before the war was exported chiefly to Germany, Holland and Scandinavia) is of considerable interest to France and her colonies. In consequence, the writer has been induced to make a thorough investigation of the value of this product for the feeding of live-stock. He gives the results of his researches carried out in collaboration with Messrs P. DEHAMBRE and LEPOUTRE at the Zootechnical Station of Grignon and at the Laboratory of Phytotechny.

Table I gives a summary of the analyses of decorticated ground-nut cake with regard to their content of digestible principles.

TABLE I. — *Composition of ground-nut cake*

A. — *Proportion of digestible principles in decorticated ground-nut cake.*

	GRANDEAU	WOLFF	KELLNER	MAYER, KIRCNER AND PETERSON
Water	12.85 %	11.5 %	9.0 %	10.3 to 13.22 %
Protein	48.44	47.0	46.7	41.3 - 50.4
Fats	6.2	7.3	6.3	5.8 - 8.1
Non-nitrogenous matter	25.99	24.1	20.0	21.45 - 28.4
Starch	1.8	5.2	0.5	2.5 - 10.1
Ash	5.42	4.9	4.5	3.8 - 5.9

B. — *Average mineral content in Rufisque ground-nut cake.*

Phosphoric acid	1.17 %	Lime	0.16 %
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The digestibility of the elements contained in ground-nut cake is given in Table II. Table II shows, according to KELLNER, the coefficients of digestibility that may be admitted in practice for determining the content in digestible principles of a cake of which the gross percentage composition is known.

TABLE II. — *Digestibility coefficients of ground-nut cake according to KELLNER.*

Organic substances	83 %
Crude protein	90
Crude fat	90
N. free extract	84
Crude fibre	9

Ground-nut cake shows the highest albuminoid content. See Table I (after KELLNER).

TABLE III. — Comparative albuminoid content of various cakes.

Decorticated ground-nut	46.7 %
Decorticated cotton cake	41.3
"Candle nut" (Fruit of <i>Aleurites moluccana</i>)	59.7
Sesame	35.8
Linseed	28.8
Colza	27.4
Copra	16.7
Palm-nut	13.5

It may be said that ground-nut cake, if pure, is a high yielding food, that is to say, it requires only a small energy output for its digestion and assimilation. Its utilisation coefficient is 98 where that of wheat is only 78, that of meadow hay 67, that of oat straw 43, that of wheat straw 32.

Ground-nut cake is often adulterated with the shells of the fruit. This greatly decreases its value.

The use of ground-nut cake in a ration means, before all else, the introduction of a high quantity of easily assimilable proteins and so is particularly adapted for feeding young and milk-producing animals, especially for high yielding dairy animals. It is equally suitable for oxen in poor condition owing to overwork and which it is required to fatten for the butcher. Owing to its slight flavour, ground-nut cake communicates no bad taste to the meat.

Rations formed of food-products cropped from the farm itself almost invariably show a deficit of protein. This lack can be readily supplied by ground-nut cake and at relatively low cost. There is undoubted advantage in introducing this cake into the rations of every day practice which, though often rich enough in non nitrogenous substances too often show a deficit of protein.

Ground-nut cake is put on the market in flat cakes or as flour. Owing to its insipidity, animals do not always accept it readily and it is advisable at first to add a little kitchen salt to the mashes and feeds containing the cake. It is administered in small quantities at first, and then continued in a progressive manner. The actual flat cake should be either powdered or broken up into fragments about the size of nut; it can then be consumed in the dry state or in the form of soup or a mash. As ground-nut cake is somewhat heating owing to its high protein content, it is advisable to introduce into the ration aqueous or emollient foods (pulp, forage roots, linseed cakes).

The dairy cow consumes, according to milk yield, from 1 to 2 kg. of ground-nut cake. Within these limits the milk and butter remain of excellent quality, but above these quantities the butter becomes soft and unsaleable. The writer and his collaborators propose to investigate what constitutes the limit dose. Ground-nut cake forms an excellent addition to rations with a turnip base; it corrects the disagreeable flavour produced in these conditions.

Ground-nut cake in flour is sometimes employed in the calf ration. A start is made with 50 to 100 gr., finishing up with 750 gr. Young stock

reives from 500 gr. to 1 kg. per 500 kg. of live-weight. The price of the cake is rather too high to allow of its every day use in the ration of working oxen or of animals for the butcher, but it serves this purpose very well.

Sheep and pigs give excellent meat on ground-nut cake.; the daily ration consists of 250 to 500 gr. per head.

In substituting ground-nut for another cake, account must be taken of its high protein content. It would be a great error to substitute it weight for weight, especially in a fattening ration.

Employment of ground-nut cake for feeding horses. — Messrs. GOUTIN and ANDOUARD have recently given an account at the Academy of Agriculture in France, of the encouraging results they have obtained by introducing ground-nut cake, in place of manioc slices, into the ration of farm horses. The writer and his two collaborators have continued these experiments on a batch of horses at the Grignon Zootechnical Station.

The taste of the horse for ground-nut cake is undoubted, the majority accept it straight away; cases of initial refusal are overcome in 2-3 days.

The cake produces no visible effect upon the health or main functions of the animal. It is therefore perfectly suited, either to replace a portion of the oats in a normal ration, or to complete a deficient ration; 1 kg. of cake is equivalent to 1.350 kg. of oats, and represents an economy of 0.14 francs.

It should be administered in progressive amounts, given at 2 separate meals when the quantity exceeds 500 gr.; the cake should be coarsely ground or crushed into fragments not exceeding a nut in size. At first it should be given mixed with dry feeds or bran; later on the animals become accustomed to taking it alone.

64 - **Sound Reasons for Pure Breeds.** — SEVERSON, B. O., in *The Field*, Vol. XXVI, No. 8, pp. 670-672. New York, August 1916.

Although pure-breeds offer a greater surety of merit in selection than scrubs, there are animals amongst them which are not necessarily desirable. The importance of individual merit even for pure-breeds may be gathered from the data contained in Table I, compiled from the Advanced Registry of the Holstein-Friesian Breed up to May 15, 1912, which includes 191 bulls.

From these facts it is apparent that the percentage of bulls having the highest number of Advanced Registry daughters come from parents that were recorded in the Advanced Registry; this is indicated by an increase from 50 to 100 %. Similarly the breeding merit of cows is determined by heredity, as is seen in Table II, which shows an increase of from 58 to 100 % in the number of daughters whose dams were entered in the Advanced Registry. With cows, as with bulls, the most prepotent animals are those whose merit depends upon performance based on heredity.

TABLE I — *Breeding of Holstein Friesian Bulls.*

(Vol. 24, "Advanced Registry").

No. of Registered Daughters per Sire	Total No. of Bulls	Both Sire and Dam in A. R. Registered per cent	Neither Sire nor Dam in A. R. Registered per cent	Sire in A. R. Registry not Dam	Dam in A. R. Registry not Sire
4-14	948	51	20	20	9
15-24	155	76	3	10	11
25-49	65	72	0	12	16
50-75	13	77	0	8	15
75 and up . .	10	100	0	0	0

TABLE II. — *Breeding of Holstein-Friesian Cows with two or more Daughters in the advanced Registry (Vol. 24).*

No. of Advanced Registry, Daughters per Dam	Dams with Records		Dams with no Records	
	No. of daughters	Percentage of daughters	No. of daughters	Percentage of daughters
2-3	2 181	58	1 604	42
4-5	286	76	89	24
6-7	18	90	2	10
8	2	100	0	0

465 — *Feeding Experiments of Pure Bred Draft Fillies in Illinois.* — EDMONDS, J. in *The Field*, Vol. XXVIII, No. 2, pp. 95-97 and 128. New York, February, 1917.

The plan of this experiment conducted at the Illinois Experiment Station included the purchase of ten pure bred Percheron fillies dropped in the spring and summer of 1914, and began December 8, 1914, being complete May 8, 1916. At the beginning of the experiment the average age of the heads was 214 days, with an average weight of 823 pounds and an average height of 13 hands, 2 1/2 inches. With the exception of a few of the most stormy nights of winter, the fillies had their choice of being outdoors in, and they usually preferred the open except at feeding times, and during the heat in the summer. The pasture season lasted from May 14 to October 11, 1915.

The accompanying table shows the feed consumption and gains for the season.

Feed consumed and gains by seasons.

Time	Average daily ration per head		Average amount of feed required per pound gain		Average daily gain in weight per head	Average total gain in weight per head	Average total gain in height per head
	Grain lbs.	Hay lbs.	Grain lbs.	Hay lbs.	lbs.	lbs.	inches
<i>First Winter</i> Dec. 8—May 13, 157 days	11.023	8.267	5.674	4.266	1.943	305.0	4.17
<i>Summer</i> May 14—Oct. 11, 151 days	6.469	3.505	7.692	4.118	0.851	128.5	1.93
<i>Second Winter</i> Oct. 12—May 8, 210 days	11.293	15.897	9.128	12.990	1.324	257.0	1.86
<i>Total: One year and 5 months</i>	28.805	27.678	12.54	11.405	1.333	690.5	7.96

The largest gains, in proportion to feed consumed were made during the first winter, with an average of 5.674 pounds of grain, and 4.266 pounds of hay required per pound gain.

The grain fed consisted of oats and corn, one half each by weight and as fed three times a day, except while the fillies were grazing, when the mixture was fed twice a day. During the first winter the oats and corn were ground and after that whole oats and shelled corn were fed. The only roughage fed was alfalfa hay, being placed before the fillies twice a day except when on pasture, during a part of which time no hay was fed at all. This method of feeding resulted in no feed being wasted, and eliminated the necessity of weighing back refused feed.

The results obtained indicate that a liberal portion of well cured legume hay is a good foundation of feed for growing horses and that, as the individual becomes older it is possible and desirable to decrease the proportion of grain and increase the proportion of hay and still obtain excellent results. A grain feed approximating one-half pound per day to the hundredweight of filly seems to be enough to produce proper development on pasture. This experiment demonstrated the superiority of alfalfa in growing the heavy muscles and large strong bones of the drafters.

An average of 45.35 bushels of corn, 79.36 bushels of oats, 2.58 tons of alfalfa and $\frac{1}{4}$ of an acre of good pastures, kept the pure bred Percherons, and in the experiment, in thrifty and salable conditions from the fall of the year in which they were foaled up to the time they were two years of age. During the 18 months in which this feed was consumed the average total gain in weight per individual was 690.5 pounds and in height 7.96 inches. The average weight of the lot at 12 months was 1112 pounds and at 24 months 1548 pounds. The average total cost of feed per head was \$56.07 for the year and \$86.88 per the 18 months. It is believed that on many farms, where pure bred are raised, the same results could be obtained

for less, rather than more expense for feed, using more pasture than was available in this trial.

466 - **The Niata Breed of Cattle in Uruguay.** — *The Journal of Heredity*, Vol. VII, No. pp. 263-265. 2 fig. Washington, D. C., June 1916.

The peculiar jaw characteristic of a bull-dog is a mutation which not confined to the dog alone, but appears from time to time in other animals. It has been reported in foxes, and CHARLES DARWIN found a whole race of cattle in Uruguay which showed this peculiarity. He described the animals as follows — forehead very short and large — the nasal end turns up — upper lip very short — lower jaws projecting beyond the upper teeth always exposed — nostrils seated very high up and very open — eyes projecting. These cattle carry their heads low on a short neck; the hind legs are rather longer compared with the front legs than is usual. This breed which is called "niata" or "ñata" is believed to have originated among the Indians southward of La Plata. The breed is very true. When crossed with ordinary cattle, offspring are produced having an intermediate character, but with the "niata" characters strongly displayed especially when the "niata" cow is crossed with a common bull.

When the grass is sufficiently long, the "niata" cattle feed with the tongue and palate like common cattle, but during the great droughts, when so many animals perish, the "niata" breed is under great disadvantage for as their lips do not join, they cannot browse on the twigs of trees and weeds as the ordinary cattle are able to do, and thus perish in greater numbers than the latter.

The American Genetic Society, with some difficulty, finally succeeded in securing 2 photographs (reproduced in the article summarised) of animals from a rancher, but it is probable that they are not full blood ñatas, for the race is practically extinct. The introduction of the best European breeds, particularly the Hereford, into Uruguay in recent years, has raised the standard of livestock so much, that it is no longer profitable to keep "ñata" cattle.

In order to prevent the entire disappearance of these interesting animals the American Genetic Association suggests that they should be bred in Zoological Gardens.

467 - **The Efficiency of Certain Milk Substitutes in Calf Feeding.** — CARR, R. I., SPITZER, C., CALDWELL, R. E., and ANDERSON, O. H., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 2, pp. 501-509. Baltimore, Md., January, 1917.

This paper contains an account of experiments carried out at Purdue Experiment Station in order to determine:

- 1) To what extent a calf meal made up of both animal and vegetable feeding materials, rich in protein, could take the place of skim milk;
- 2) Whether the proteins from wholly vegetable sources are capable of producing growth and development of the calf to the same extent as the proteins from animal sources.

The skim milk, prepared by a cream separator, was fed fresh at a temperature of about 90° F., or practically body temperature. The calf meal

fed at the same temperature as the skim milk, were mixed with water, 4 ounces of meal to 3 pounds of water at first, increasing to 12 ounces of meal to 9 pounds of water. The dry mash consisted of equal parts of ground corn and oats. The alfalfa hay was also fed dry. Salt and water were allowed *ad libitum*. The calves were allowed as much of each feed as they would consume, and any rations that were left were carefully weighed. Tables I and II give a record of the feeding periods and feeds received by each calf.

TABLE I. — *Feed Chart.*

Feeding Periods and Feeds Received by Each Calf.

Calf	B 40	B 43	B 41	B 44
Period I 29 days	Skim milk Alfalfa hay Dry mash	Skim milk Alfalfa hay Dry mash	Vegetable meal Alfalfa hay Dry mash	Home mixed meal Alfalfa hay Dry mash
Period II 25 days	Home mixed meal Alfalfa hay Dry mash	Vegetable meal Alfalfa hay Dry mash	Skim milk Alfalfa hay Dry mash	Skim milk Alfalfa hay Dry mash
Period III 18 days	Vegetable dried blood meal Alfalfa hay Dry mash	Home mixed casein meal Alfalfa hay Dry mash	Vegetable dried blood meal Alfalfa hay Dry mash	Home mixed casein meal Alfalfa hay Dry mash

TABLE II.

Composition of Meals.

1) Vegetable meal . . .	<div>Linseed meal . . . Soy bean meal . . . Cottonseed meal . . . Wheat middlings . . .</div>	Equal parts by weight. N. 4.97 per cent.
2) Home mixed meal . .	<div>Hominy feed . . . Linseed meal . . . White Swan flour . . . Dried blood . . .</div>	
3) Vegetable dried blood meal	<div>Soy bean meal . . . Linseed meal . . . Cottonseed meal . . . Wheat middlings . . . Dried blood . . .</div>	
4) Home mixed meal	<div>Hominy feed . . . Linseed meal . . . White Swan flour . . . Casein . . .</div>	
	<div>9 parts by weight 9 " " " 9 " " " 8 " " "</div>	N. 5.02 per cent.

Nitrogen content of other feeds:

Skim milk	N. 0.55 per cent.
Mash	N. 1.46 per cent.
Alfalfa hay	N. 2.53 per cent.

Tables and diagrams are given of the following data obtained by taking an average of the figures by 3 day periods: — nitrogen intake, nitrogen retained, total nitrogen excreted in urine, nitrogen excreted in the form of urea, nitrogen excreted in the faeces, the body weight, the body gain, the weight of the urine and the amount of dry matter or solids in the faeces. The results obtained are summarised as follows:

I. — *Percentage retained of nitrogen consumed in the ration:*

Skim milk ration	40.7
Home mixed meal	32.0
Home mixed casein meal	30.0
Vegetable meal	27.3
Vegetable dried blood meal	22.6

II. — *Division of excreted nitrogen:*

	In urine	In faeces
Skim milk ration	50.5	49.6
Home mixed casein meal ration	46.3	53.7
Vegetable meal ration	41.2	58.8
Vegetable dried blood meal ration	35.0	64.9
Home mixed meal ration	34.2	65.2

III. — *Gain in gm. of body weight per gm. of nitrogen consumed for the different rations.*

	gm.
Skim milk	34.41
Home mixed casein meal ration	32.74
Vegetable dried blood meal ration	26.85
Home mixed meal ration	26.17
Vegetable meal ration	26.14

CONCLUSIONS: — 1) The nitrogen intake was rather constant per kilo of body weight. The maximum difference was 12 per cent.

2) Less nitrogen was excreted from the vegetable ration than from the dried blood ration, there being a difference of 4.7 per cent.

3) It seems that when the nitrogen in the ration was the most suitable for growth, the nitrogen excreted was about evenly divided between the faeces and the urine.

4) The total nitrogen excreted from each of the five rations indicates that the nitrogen in the skim milk ration was absorbed to the greatest advantage and the other feeds in the order named: home mixed meal, home mixed casein meal, vegetable meal, and vegetable dried blood meal.

468 — **Lamb Feeding in Texas.** — JONES, J. M., in *The Breeder's Gazette*, Vol. LXXI, No. 7, pp. 327-328. Chicago, February 15, 1917.

Feeding experiments have been carried out on a large farm in Coleman county by the Texas Experiment Station with a view to obtaining reliable information regarding the use of cottonseed meal, cottonseed hulls and silage hulls, and silage made from sorghum and feterita in the fattening of sheep.

	1st period: 59 hours		2nd period: 24 days		3rd period: 19 days		4th period: 17 days		
	Group I	Group II	Group I	Group II	Group I	Group II	Group I	Group II	
<i>Daily ration:</i>									
Cottonseed meal	0.236 lb.	0.229 lb.	0.445 lb.	0.318 lb.	0.445 lb.	0.37 lb.	0.448 lb.	0.366 lb.	
Cottonseed hulls	0.898 lb.	—	1.00 lb.	—	1.017 lb.	—	0.99 lb.	—	
Borghum and feterita silage	2.24 lb.	3.78 lb.	2.53 lb.	3.46 lb.	2.68 lb.	3.48 lb.	2.59 lb.	3.46 lb.	
Milo and feterita chops	—	—	—	0.89 lb.	—	1.04 lb.	0.736 lb.	1.03 lb.	
Daily cost of ration	\$ 0.0013	\$ 0.0095	\$ 0.0127	\$ 0.0198	\$ 0.0132	\$ 0.0222	\$ 0.02	\$ 0.022	
Average daily gain for each period	0.140 lb.	0.285 lb.	0.31 lb.	0.34 lb.	0.173 lb.	0.285 lb.	0.048 lb.	0.24 lb.	
Cost per pound of gain	\$ 0.0267	\$ 0.312	\$ 0.0411	\$ 0.0579	\$ 0.0760	\$ 0.0777	\$ 0.29	\$ 0.0909	
		Group I		Group II		Group I		Group II	
		—		—		—		—	
Average daily gain for first 2 periods		0.338 lb.		0.302 lb.		—		—	
Cost per pound of gain for first 2 periods		\$ 0.0305		\$ 0.0413		—		—	
Average daily gain for last two periods		—		—		0.120 lb.		0.202 lb.	
Cost per pound of gain for last 2 periods		—		—		\$ 0.135		\$ 0.083	

For the experiment, 501 lambs of the Shropshire Delaine cross were divided into two lots of 250 and 251 each. The tests were carried out in four periods of 59-24-19-17 days respectively. Table I shows the composition and cost of the daily ration as well as the gain in weight and the cost of this gain.

The experiments showed that silage when fed to lambs in moderate quantities gives good results in every way. In spite of its high water content it did not appear necessary to add dry roughage to the ration of fatteners receiving silage. The animals of Group I which were fed cottonseed hulls showed, in the 1st period (59 days), a greater increase in weight than those of Group II, which received a larger amount of silage but no dry roughage. On the other hand, when milo and feterita chops were added to the ration, Group II showed a greater increase in weight than Group I throughout the duration of the experiment. These facts show that the addition of dry roughage to a silage ration is advisable from an economic point of view although not strictly necessary from a hygienic standpoint. The lambs of Group I returned a profit of \$ 1.03 per head, or 38.3 % on the original investment, whereas those of Group II returned a profit of 82 cents per head or 30.3 % on the original investment.

469 - Injurious Effect of Palpating Laying Hens in order to determine the Presence of Eggs. — KIRRI, TH., in *Monatsshefte für praktische Tierheilkunde*, Vol. 28, Part 3, pp. 256-265. — Stuttgart, March 20, 1917.

Many poultrymen have the habit of palpating laying hens every day about the abdomen in order to ascertain the presence or not of an egg. This practice is usually inoffensive, but it is sometimes the cause of lesions more or less serious in character and in some cases even followed by death. Undoubtedly, it is not always followed with the necessary care and it often happens that the liver and the eggs themselves are crushed. When done by an inexperienced person it may be the cause of regular mortality among the poultry which is often wrongly attributed to epidemics or poisoning. Journals dealing with poultry have hardly ever mentioned a case of death due to this cause.

In the majority of cases, fowls which have been too roughly handled have their livers ruptured, especially where this organ has been rendered delicate by overfeeding. As a result, internal hemorrhage occurs which may be immediately confirmed, when the abdominal cavity is opened, by the presence of extravasation of blood and coagulum among the intestines and upon the rupture of the liver. Death is not always immediate but the animals succumb the following day, following symptoms of paralysis.

Rupture of the liver, however, may be due to other causes, such as particularly violent efforts of the male in copulation or to the body of the fowl being squeezed between the laths of a garden coop or in a too narrow passage.

The crushing of eggs owing to hand pressure is rarer if the egg has reached the lower portion of the oviduct and if it is already provided with the calcareous shell than when it is still in process of formation. In the latter case the incompletely hardened shell is crushed. Still more frequent is the case where the eggs are crushed in the ovarian follicles in the middle

of the abdominal cavity. In this case the body cavity is quite full of yolk which makes its way into all the interstices and folds between the intestines and the air sacs. Internal hemorrhage and foci of inflammation being completely absent in such cases the cause of death is problematic. The writer considers that portions of yolk from the body cavity, obtaining access to the bronchi opening into the abdominal air sacs, may be inhaled into the lungs, death then ensuing owing to asphyxia.

The presence of yolk in the abdominal cavity is not always to be imputed to the crushing of an egg as a result of a traumatic lesion. In several illnesses it may happen that one or more ovarian follicles may be released prematurely and the yolk spread into the abdominal cavity. For instance, this is one of the initial symptoms in fowl cholera and especially in the Lombardy disease of poultry. The yolk may also burst into the abdominal cavity when there is an obstruction of the oviduct. In such cases the newly formed eggs without shell become massed in the oviduct, increase in size and often leak into the body cavity.

Where the accumulation of yellow in the body cavity does not actually result in death as described above, it is still followed by internal troubles. After partial reabsorption of the aqueous portion of the yolk there remain behind hard and fatty portions which seal together more or less closely the organs of the abdomen. The result is interference with the peristaltic functions and the animals eventually die of "cibostasis" (stoppage of digestion).

Many poultry keepers also feel for the presence of an egg by introducing the finger into the cloaca. This is a very bad practice as lesions may result. There is also considerable risk of infection causing inflammation of the oviduct.

470 - **Breeding of 8 Chinese Races of Silkworms at the "Osservatorio bacologico Marson" at Vittorio Veneto, Italy.** — MARSON, D., in *Informazioni Seriche*, Year IV, No. 4, pp. 76-77. Rome, February 20, 1917.

The following races have been studied, imported by the MARI mission:

Large white oval from Zi-Ka-Wei	50 cells
Chinese gold from Sagnev.	80 "
Chinese gold from Vusih.	50 "

The layings from each moth were reared separately in order that the selection should be carried out under the strictest conditions. The results obtained are as follows:

1) *Large white oval from Zi-Ka-Wei* (cells received 50; found healthy 19).

Average duration of 8 breedings: 24 days. Worms white rather big, rather lacking in agility, method of progress regular. One breeding lot was abandoned where some worms were found to be poorly developed at the 4th period. Cocoons oval, white, developed, average resistance and rather coarse grain; 62 live cocoons weigh 100 gr. Dimensions in centimetres:

	Maximum	Minimum	Average
Width	2.10 cm.	1.90 cm.	2.00 cm.
Length	4.10	3.40	3.75

This race showed no remarkable features; however, the proportion of double cocoons was fairly high and reached in some cases 9 %. After rigorous selection, the cocoons have been reproduced.

2) *Chinese gold from Sagnew* (cells received 80; found healthy 3).

The three small breedings were carried out at Carpisica, Ogliano and Fregona respectively. The first two have given the following results:

Duration of breeding period: 21-23 days — Cocoons oval, lemon gold; tissue compact: 47-39 — Cocoons oval lemon gold, shade only slightly uniform, light: 26-21 — Cocoons of faded greenish yellow, very light: 8-22 — Cocoons silvery white, some spherical but the majority oval and finely grained: 22-19 — Double cocoons: 6-14.

The lemon gold cocoons with consistent tissue were reproduced. 79 cocoons weigh on an average 100 grams. Dimensions in centimetres:

	Maximum	Minimum	Average
Length	3.10 - 3.20 cm.	2.50 - 2.90 cm.	2.80 - 3.05 cm.
Breadth	1.90 - 2.00	1.60 - 1.90	1.75 - 1.95

The 3rd. breeding, which was normal and lasted 22 to 24 days gave: 31 semi-spherical cocoons, bright gold and rather fine grain, resistant and extremely well developed, as the following figures show:

Length 3.1 cms; breadth 2.1 cms.

63 live cocoons weigh 100 gr.

46 cocoons of similar shape and dimensions to the preceding ones but less developed, 77 weigh 100 gr. Average dimensions: Length 2.7 cms.; breadth 2.1 cms.

13 white cocoons, some round, the rest oval.

3 straw-coloured cocoons, semispherical.

23 greenish yellow cocoons, only slightly uniform.

6 double cocoons.

In view of their marked difference in size the two bright gold types were bred separately. They deserve attention owing to the richness of their silk and the bright colour of the cocoon.

3) *Chinese gold from Vusih* (cells received 50; found sound 13).

Average breeding period: 22 days. Worms active, method of progress regular. The cocoons obtained were at first mostly lemon yellow in colour, acquiring later a uniform greenish yellow tint. Fairly compact. A certain number yellowish gold colour of various shades, extremely light. Practically an equal number of white, round to oval, some tinged with silver, which have been in part reproduced. The proportion of double cocoons varies between 4 and 6 %. The oval, lemon or yellowish gold cocoons were reproduced after rigorous selection; 81 cocoons weigh 100 gr.

	Maximum	Minimum	Average
Length	2.90 cm.	2.70 cm.	2.75 cm.
Breadth	1.80	1.50	1.65

In view of the above results, especially with regard to *Sagnew gold* and *Vusih gold*, the writer concludes these races are not pure. They show

marked disparity of characters both in the worm and in the cocoon. In order to impress upon the new types *Sagneu gold* and *Vusih gold* certain relatively constant characters, the writer intends to employ selection by families. This stability he hopes to bring about by the *separate* breeding of worms of the same family, even under diverse climatic conditions, according to the method advocated by ANDRÉ.

471 - **Development of Sericulture in Japan.** — *Bulletin de l'Association sericole du Japon*, 2nd. Year, No. 8, pp. 20-22. Tokyo, 1st. Nov. 1916.

Table I, which summarises the data relating to production of cocoons and the percentages of the 3 harvests, spring, summer and autumn, fort

TABLE I. — *Production of cocoons and crop percentages for the 27 years from 1890-1915.*

Years	Spring cocoons	Summer cocoons	Autumn cocoons	Total	Crop percentages		
					spring	summer	autumn
	hectolitres	hectolitres	hectolitres	hectolitres			
1890	1 549 003	440 777	120 310	2 110 090	73 %	21 %	6
1891	2 182 164	506 140	156 128	2 844 432	76	18	6
1892	2 023 600	453 742	187 927	2 665 269	76	17	7
1893	2 205 032	591 464	239 913	3 036 409	72	19	9
1894	2 264 103	673 193	298 818	3 236 116	70	21	9
1895	3 056 045	583 250	425 416	4 064 711	75	14	11
1896	2 491 940	459 788	344 752	3 296 480	75	14	11
1897	2 978 500	491 862	349 137	3 819 499	78	13	9
1898	2 707 832	542 507	398 871	3 649 210	74	15	11
1899	3 275 885	659 856	576 871	4 522 612	72	15	13
1900	3 653 651	679 439	623 935	4 957 025	74	14	12
1901	3 237 610	622 110	687 406	4 547 126	71	14	15
1902	3 194 885	647 590	746 129	4 588 604	70	14	16
1903	3 040 975	682 015	1 000 440	4 723 430	64	15	21
1904	3 331 625	703 724	1 050 867	5 086 216	65	14	21
1905	3 189 157	661 811	1 051 031	4 901 999	65	14	21
1906	3 357 002	744 460	1 245 847	5 347 309	63	14	23
1907	4 034 786	841 848	1 342 906	6 222 540	65	14	21
1908	3 969 884	857 434	1 526 985	6 354 303	62	14	24
1909	4 142 349	836 318	1 555 094	6 533 761	63	13	24
1910	4 363 324	905 161	1 753 247	7 021 732	62	13	25
1911	4 611 818	949 351	2 062 354	7 623 523	61	12	27
1912	4 625 676	960 683	2 427 793	8 014 152	57	12	31
1913	4 671 543	961 780	2 631 461	8 264 786	57	12	31
1914	4 687 048	905 510	2 349 472	7 942 030	59	14	27
1915	4 659 645	1 050 700	2 655 025	8 365 370	56	13	31

TABLE II. — Increase in production of cocoons in Japan from 1906 to 1915.

Years	Weight of seed incubated — grams	Production of cocoons — hectolitres
1906	75 051 552	5 347 305
1907	82 190 731	6 222 541
1908	84 448 254	6 354 302
1909	85 253 075	6 533 761
1910	89 717 433	7 021 732
1911	93 790 337	7 623 522
1912	95 213 431	8 014 153
1913	95 655 665	8 264 786
1914	94 458 630	7 942 030
1915	98 861 268	8 365 370

TABLE III. — Production from crossed races in Japan from 1913 to 1915.

A. — Number of spring layings.

Races	1913	1914	1915
European yellows	1 737 394	3 314 039	4 997 873
European whites	2 917	30 534	156 198
Chinese yellows	4 732	10 330	217 469
Chinese whites	3 251 502	2 900 380	6 546 889
Hybrid yellows (Europe and Asia)	8 304 923	13 313 524	13 691 394
Hybrid whites (Europe and Asia)	—	—	21 247 949
Japan and Chinese crosses	5 993 412	6 841 246	15 773 098
Native race	191 584 379	171 671 298	166 650 269
Totals	210 879 259	198 081 351	229 281 139

B. — Number of spring laying * sheets.

Races	1913	1914	1915
European yellows	2 980	1 260	2 110
European whites	—	7	42
Chinese yellows	113	—	55
Chinese whites	769 932	14 243	13 873
Hybrid yellows (Europe and Asia)	4 587	6 274	3 192
Hybrid whites (Europe and Asia)	—	—	3 386
Japan and China crosses	52 488	47 254	62 264
Native race	1 353 386	1 235 880	1 185 352
Totals	1 499 546	1 306 918	1 278 274

* 1 laying sheet = 18.54 gr. of silkworm seed.

the past 27 years, shows that the spring and summer crop percentages tend gradually to diminish, whilst the autumn production steadily rises, very rapidly in fact during recent years.

Table II shows that the production of cocoons has been on the increase since 1906.

Table III shows for 1913, 1914 and 1915, the number of layings and reared sheets from various white or yellow hybrid races which give cocoons of better quality than the native races.

72 - **Carp Breeding in Madagascan Rice Fields** (1). — LEGENDRE, JEAN, in *Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 163, No. 15, pp. 377-378. Paris, October 9, 1916.

In view of the readiness with which certain fish feed upon mosquito larvae, the writer advocates the breeding of fish in rice fields in order to combat malaria.

The fish best adapted to the warm, still waters of rice fields are members of the Carp family (*Cyprinidae*).

Acclimatisation and breeding experiments have been carried out near Tananarive (Madagascar). In part they have been conducted with native species, in part with mirror carp from France and MAILLART carp from Reunion.

While awaiting the results of these experiments the writer has demonstrated that the Chinese carp, which already existed in the Colony, breed and develop rapidly in the rice fields and devour the greater part of the larvae which live in the waters.

The eggs are laid upon the submerged portions of the rice plant and thanks to the biological conditions of the environment, the fry develop at a surprising rate: 1300 of these fish (weighing altogether about 6 kg.) introduced into a rice field, gave, in 5 months, 18 000 fish (120 kg.). These figures give an idea of the importance this fish breeding in rice fields may acquire. The writer calculates that Madagascar is capable of producing 35 000 tons of fish.

FARM ENGINEERING.

73 - **The Comparative Costs of Using Agricultural Machinery in the United States and in France.** — RINGELMANN, MAX, in *Journal d'Agriculture pratique*, Year 81, No. 1, pp. 18-20. No. 2, pp. 29-30. Paris, January 11 and 25, 1917.

AGRIC
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To supply information to a number of persons wishing to undertake certain agricultural operations, the writer ascertained the average cost of using various machines, using as a basis an inquiry made by Mr. H. H. Mowbray amongst the farmers in the west of New York State (2).

IMPL

(1) See also, in B. 1916, pp. 1376-1379; Dr. F. SUPINO's paper: *Carp-breeding in Italian Rice Fields*, (Ed.).

(2) Results published in the *United States Department of Agriculture, Bulletin* No. 338, p. 24, summarised in B. 1916, No. 1110. (Ed.).

In Table I are summarised the conditions of use resulting from the average figures obtained in the inquiry, the life of the machine and the total surface they worked during their working life on the farm being shown in round figures.

TABLE I. — *Life and work of agricultural machinery.*

Machines	Average number of working days per year	Life of the machine		Area worked	
		Number of years	Total days of work	Per year	Total
				acres	acres
Still plough	19.2	11.7	225	32.52	329
Seat plough	14.7	8.1	119	30.54	247
Pulveriser	4.2	13.0	55	34.79	452
Spring-tine harrow	6.6	11.0	73	70.28	1465
Tooth-harrow	3.1	14.0	44	47.72	678
Roller	4.7	16.0	76	65.14	1043
Cereal drill	4.0	16.4	76	45.76	751
1 row hoe	4.1	14.0	58	16.70	235
2 row hoe	5.6	12.5	70	38.84	488
Mower	3.1	14.8	46	27.78	410
Hay-maker	1.5	14.0	21	21.35	298
Horse rake	2.6	14.5	38	42.50	618
Harvester and binder	3.4	15.4	53	34.79	536

In France one plough is sufficient for 40 acres of land, or for about 17 acres of arable land or, again, for about 12 acres of land cultivated every year. On the other hand, under intensive cultivation, an average minimum of 1.6 acres of cultivation is done per acre per annum; therefore with one plough for about every 17 acres, it would have to cover an average surface of 28 acres a year, which is close to the figures given in the American inquiry (30.39 and 32.37 acres covered per plough per year).

Some time before the war, the writer showed that it paid to use a combined harvester and binder when there were at least 25 acres of cereals to cut (*Journal d'Agriculture pratique*, 1901, Vol. I, No. 16, p. 506; 1904 Vol. II, No. 21, p. 144).

As regards the average area per harvester and binder as used in France though accurate figures are wanting, they vary from 62 to 175 acres of cereals per machine.

Allowing for the fact that the sale price of agricultural machinery is less in America than in France, the writer has calculated the cost of upkeep per 100 shillings of sale price, as shown in Table II.

TABLE II. — *Cost of upkeep of agricultural machinery.*

Machines	Average sale price in the United States	Cost of upkeep per acre worked				
		In United States		per 100 s. of sale price		
		New parts	Repairs	New parts	Repairs	Totals
Stilt plough	44 s	1.69 d	3.08 d	0.80 s	1.45 s	2.25 s
Seat plough	164	8.47	3.47	1.00	0.41	1.41
Pulveriser	111	2.93	0.69	0.55	0.13	0.68
Spring-tine harrow	71	1.16	0.58	0.33	0.17	0.50
Tooth-harrow	44	0.77	0.39	0.36	0.18	0.54
Roller	99	0.39	0.39	0.08	0.08	0.16
Cereal drill	297	4.77	1.35	0.33	0.09	0.42
1 row hoe	71	1.35	1.04	0.39	0.30	0.69
2 row hoe	125	3.27	1.27	0.50	0.20	0.70
Mower	164	4.97	2.89	0.60	0.34	0.94
Hay-maker	143	5.62	0.96	0.81	0.14	0.95
Horse rake	99	1.93	0.42	0.40	0.09	0.49
Harvester and binder	515	11.55	2.93	0.46	0.12	0.58

For ploughs, the writer thinks it advisable, in fairly light soil, to change the share in summer, so as to set it 6 or 7 times per acre, at 7d. a time, thus costing 3s. 8d. to 4s. per acre. After September, when the soil is moister, sharpening once for every 3 or 4 acres is sufficient. In 2 months, 5 turn-wrest ploughs cost over 63 shillings for sharpening the shares. The share is worn out after ploughing 45 acres, and a new one of ordinary steel costs about 6 shillings, i. e. about three half-pence per acre. A hardened steel share costs over 10 shillings, but lasts much longer; but it is liable to break in stony ground if not carefully made.

These prices are pre-war, and compared with those of Table II they enable the American figures to be accepted as general averages.

As regards other costs the writer has not used the American work as a basis, for it only provides for a low rate of interest on the capital invested and on the average area worked each year by each machine as shown in Table I.

The writer admits: interest at 5 %; depreciation at 5 % for 10 years, which is equal to 12.9 %; plus 2 % to cover various expenses and risks; so that the calculation is based on 15 % of the buying price and on a minimum number of acres worked annually in France by the different machines; to these costs are added those of upkeep and the totals representing the costs of using the various machines per acre worked and per 100 shillings of price of the machine (see Table III).

AGRICULTURAL MACHINERY AND IMPLEMENTS

TABLE III. — *Cost of using agricultural machinery.*

Machines	Expenses per acre worked per 100 shillings of cost price			
	Area worked per year	Interest, depreciation and risk	Maintenance charges	Total
	acres	shillings	shillings	shillings
Stilt plough	25	0.61	0.91	1.52
Scot plough	37	0.40	0.57	0.97
Pulveriser	25	0.61	0.27	0.88
Spring-tine harrow	50	0.30	0.61	0.91
Tooth harrow	50	0.30	0.22	0.52
Roller	50	0.30	0.65	0.95
Cereal drill	62	0.24	0.17	0.41
1 row hoe	50	0.30	0.28	0.58
2 row hoe	50	0.30	0.28	0.58
Mower	62	0.24	0.38	0.62
Hay-maker	62	0.24	0.38	0.62
Horse rake	62	0.24	0.20	0.44
Harvester and binder	62	0.24	0.23	0.47

Under these conditions the hiring price, without profit, should be about 25.6 shillings for the drill and 3.5 shillings for the harvester.

Table III only gives indications as the costs of use per acre decrease as the area increases. This decrease only affects the interest, depreciation, and capital risks, and not the maintenance expenses in relation to the unit of area. As an example, the writer gives the two following examples.

For a seed drill costing 453 shillings, working 62 acres each year, the costs would be 2s. 4d. per acre including 9d. for new parts and 1 1/4d. for various repairs as shown in Table II.

For a combined harvester and binder costing 790s., working 62 acres each year, the costs would be 3s. 9d. per acre, including 1s. 5d. for new parts and 4 1/4d. for various repairs.

474 — *The Comparative Cost of Tractor and Horse Power, in the United States.* — MORRISON, F. L., in *Farm Implement News*, Vol. XXXVIII, No. 6, pp. 43-45. Chicago, February 8, 1917.

To show the economic advantages presented by the tractor, the writer has made this comparison between the costs of keeping horses and a tractor of equal power.

The cost of upkeep of a horse varies very widely. Of late years, the expense has continually increased owing to the higher cost of hay, oats, and labour.

According to the official estimates of the United States Agricultural

department, the cost of upkeep of a horse that was about 80 dollars a few years ago, had increased to 98 dollars in 1912 and to 129 in 1914. In 1916, the writer reckons the cost to be 167 dollars. Thus the cost of upkeep of a horse has doubled in the last 15 years; in calculating it, the writer has taken into account the interest on capital, depreciation of the animal and harness, food, attendance and shoeing. A ration of 4600 pounds of grain and 6300 pounds of hay per horse per year has been taken as a basis, being figures obtained in an investigation in Minnesota.

On an average 160-acre farm, at least 4 horses are required; the maintenance charge for these horses would be \$ 668.76.

For an 8HP tractor costing \$ 1000, the maintenance charges are:

Interest on investment at 6 %	\$ 60
Depreciation and repairs at 20 %	\$ 200
20 gallons of kerosene at 7.7 cents per gallon	\$ 1.54
1 gallon of oil at 35 cents per gallon	\$ 0.35
therefore for 100 working days	\$ 189.00
Labour and miscellaneous expenses (not including driver's wages).	\$ 19.87
Total	\$ 468.87

It is seen that the maintenance of an 8 HP tractor costs 200 dollars less than that of 4 horses, which cost about 250 dollars each in the United States. Therefore the cost price is the same in both cases.

As regards the comparative cost of a day's work, some official estimates show that a farm horse works from 700 to 1000 hours a year. Taking the most favourable figure, a horse costs 16.7 cents for each hour of work, the annual cost being \$ 167.19.

A 160-acre farm, which is taken as the economical minimum of size for tractor employment, requires 4 horses for the work; therefore the cost per hour of horse labour amounts to 66.8 cents.

The tractor maintained at an expense of \$ 468.87 for the year, also will work 1000 hours, at a cost of 46.8 cents per hour, or as it is 8 HP, it will cost per horse power only 5.8 cents. This is an advantage in favour of the tractor of nearly 11 cents per horse power hour. In fixing the rate of depreciation the writer reckons it at 20 % of the cost price, for he thinks that the life of a tractor is very limited, whilst he values the depreciation value of the horses at only 10 %.

15 - **The Ransome Three-Row Ridger.** — *The Implement and Machinery Review*, Vol. 42, No. 503, p. 1238 + 1 fig. London, March 1, 1917.

MESSRS. RANSOMES, SIMS & JEFFRIES, of Ipswich, produce a three-row ridger for potato growers who do not favour the use of a combined cultivator and rider.

The main frame is of steel and is quite rigid when fully expanded. Complete control of the implement is afforded by a simple steerage, and it can be adjusted to cover drills varying from 24 in. to 30 in. apart. The ridger bodies are three in number and are built so as to leave a "sole" in

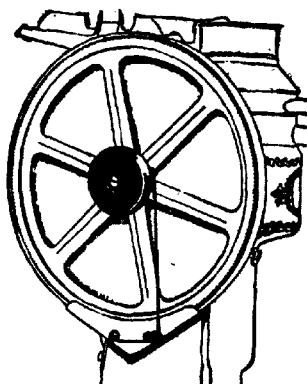
the bottom of the drill, suitable for setting seed potatoes. The steel breast are adjustable and have chilled cast-iron points.

The machine is a ridger pure and simple, and with it from 8 to 9 acre can be covered in a day when worked with three horses and a man.

476 - Tests of the "Omega" Milking Machine (1) at the Federal Dairy Station, Liebfeld, Switzerland. — See No. 483 of this Bulletin.

477 - Speed Indicator for Hand-worked Cream Separators. — *Farm Implement News*, Vol. XXXVIII, No. 8, pp. 29-30. Chicago, Ill. February 22, 1917.

It is generally admitted that the usual speed given to hand-worked cream separators is often too low, being below that indicated by the maker.



Speed Indicator for the DE LAVAL Separators.

Tests at the Purdue Experiment Station showed that the loss of cream due to insufficient speed would amount to a considerable figure.

To avoid this loss, the DE LAVAL separators have been provided with a bell speed-indicator of reliable and simple construction. When the operator begins turning the crank of the separator, the bell rings with a clear loud note at each revolution of the crank handle, but the moment the machine is running at the proper speed, the bell stops ringing. Should the speed drop below the indicated one, the bell begins to ring again. The device enables the work to be easily controlled.

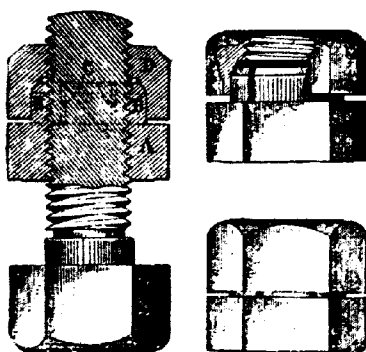
478 - Brine Tank Refrigerator Cars for Fruit Shipment, Used in Canada. — See No. 48 of this Bulletin (with illustration).

(1) See also B. 1915, No. 212.

(Ed.).

479 - **Lock Nut Made by the Western Screw and Lock Nut Company of San Francisco, United States.** — *Iron Age* October 1916: quoted in *Le Génie Civil*, Vol. LXX, No. 1805, p. 183. Paris, March 17, 1917.

The nut is made up of the nut itself and its cap. The nut *A* has an annular projection *B* slightly receding towards its upper part and split in 4 parts by two diametrical cuts *C*. The cap *D* is a screw hollowed out below so as to fit on the projection *B*.



Lock Nut made by the "WESTERN SCREW & LOCK NUT COMPANY" of San Francisco.

When the nut is in place and tightened up, the cap is screwed on, down over the projection. The cap, pressing on the 4 parts, clamps them on the thread of the bolt so that the nut is held quite firmly in place.

An advantage of this nut is that it does not strip the threads, as often happens in ordinary nut and bolt combinations.

480 - Review of Patents.

Village Machines and Implements.

France	20 205	Subsoiler for tractor.
	20 246	Apparatus for cultivating between rows of vines.
	20 248	Cultivator for use between vines.
	481 978	Digger.
	482 155	Motor plough for various work in vineyards.
	482 175	Motor balance-plough.
	482 276	GALARDI & PATUZZO motor plough.
	482 296	Improved plough.
	482 434	Pulveriser attachment for ploughs.
	482 444	Tool for use as pick axe, mattock, spade and lever.
Germany	296 182	Hoe with the working parts adjustable with regard to the land wheel.
United Kingdom	15 857 — 103 302	Motor ploughs.

United States	1 212 295	Cultivator shovel.
	1 212 563	Combined weeder and cultivator.
	1 212 695	Device for raising harrows.
	1 212 772 — 1 213 336 — 1 214 361	Motor ploughs.
	1 212 950 — 1 213 050 — 1 215 096 — 1 215 186	Cultivators.
	1 212 957	Harrow evener.
	1 213 281	Disc harrow.
	1 213 553	Harrow attachment for gang ploughs.
	1 213 842	Ploughing tractor.
	1 214 002	Gang-plough.
	1 214 463	Land-roller.
	1 214 961	Spring-time harrow.
	1 214 993	Plough.

Irrigation.

Germany	296 184	Irrigation device with several spraying-carts connected by flexible tubes.
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Manures and Manure Distributors.

Austria	73 189	Manure spreader.
Canada	173 195	Process for manufacturing ammonium sulphate.
France	481 915	Fertiliser made by oxidising the solid residues from sewage waters.
	482 181	Process for treating phosphates.
United Kingdom	15 432	Treatment of feldspar, etc., to render the potassium <i>min</i> available.
	16 558	Process for rendering phosphates citric-soluble.
	16 658	Neutral bacterised-peat manure.
	103 142	Manure made by combining peat with oxidised sewage residue.

Drills and Sowing Machines, etc.

Austria	73 190	Potato planter.
	73 191	Seed drill sowing at different depths.
	73 368	Seed drill.
France	482 174	Improved seed-drill.
Germany	296 048	Seed-drill.
United States	1 212 414	Seeding machine.
	1 212 477 — 1 212 946 — 1 213 411 — 1 215 125	Planters.
	1 213 112 — 1 214 577	Maize planters.

Various Cultural Operations.

Canada	172 975	Bean clipper.
	173 062	Pruning-knife.
France	481 992	Arrangement for tying up vine-branches.
Germany	295 621	Electrochemical method for treating the soil and the crop
	296 183	Grafting-knife.
United States	1 213 502	Maize header.

Control of Diseases and Pests of Plants.

Canada	173 081 — 173 233 — 173 484	Animal trap.
	173 237	Fly trap.

France	482 008	Apparatus for protecting plants against hail, frost, insects, slugs, birds, mice, etc.
	482 077	Liquid insecticide.
	482 111	Sprayer for treating fungous diseases of the vine, etc.
	482 249	Animal trap.
United Kingdom	16 044	Electrical apparatus for destroying insects.

Reapers, Mowers and Harvesting Machines.

Austria	73 184	Reaper
Canada	172 985	Harvester.
	173 413	Binder mechanism.
France	481 912	Improved ear cutter.
	481 940	Teeth for knife bars of mowers and reapers.
	481 964	Side delivery for reapers that can be put in or out of gear.
	482 307	Motor mower.
Germany	295 601	Fore-wheels for harvester.
United Kingdom	103 257	Haysweeps.
United States	1 212 167	Mower attachment.
	212 427	Mowing machine knife bar.
	1 621 244	Seed gatherer.
	1 212 899 — 1 213 151 — 1 214 490	Cotton-pickers.
	1 213 629	Maize harvester.
	1 213 942	Mowing machine.
	1 214 242	Harvesting machine.
	1 214 564	Motor attachment for binders.
	1 214 653	Pea harvester.
	1 214 944	Support for grain-binder engines.
	1 215 191	Grain shocking machine.

Machines for Lifting Root Crops.

Germany	295 650	Potato-lifting machine with a wheel or other delivery device
	296 254	Potato-getter with 2 superimposed moving platforms.
United Kingdom	15 817	Potato diggers.
United States	1 212 931 — 1 214 381	Beet-topping machines.

Threshing and Winnowing Machines.

Germany	295 787	Straw-trusser and chopper mounted on wheels and adaptable to a thresher.
United States	1 213 101	Seed cleaner and separator

Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.

Canada	172 964	Car unloader.
	173 431	Hay rack.
Germany	296 004	Baling machine with needles locked by the piston.
	296 273	Device for binding with iron wire in baling presses, etc.
United Kingdom	16 019	Device for cleaning and sorting fruit.
United States	1 212 273	Portable elevator and wagon dump.
	1 213 056	Maize slicer.
	1 213 158	Hay press.
	1 214 460	Maize cutter.
	1 215 108	Turn table for corn stacking machines.

Sylviculture.

Austria 73 369 Receptacle for collecting resin.

Traction of Agricultural Machinery.

France 20 249 Agricultural tractors.

United Kingdom 15 388 — 16 101 Tractors.

United States 1 212 284 Tractor drive-wheel.

1 212 525 — 1 212 710 — 1 214 643 — 1 214 673 — 1 215 147 Tractors.

1 212 718 Draft-equaliser.

1 213 385 Movable tractor draw-bar.

1 213 842 Ploughing tractor.

1 214 545 General purpose farm tractor.

Feeding and Housing of Livestock.

Canada 173 071 — 173 214 Horse-shoes.

Germany 295 554 Horse shoe.

296 061 Device for tying up cattle.

Switzerland 74 711 Device for holding a cow's tail.

Aviculture.

Canada 173 053 Egg-tester.

United Kingdom 15 679 — 16 033 — 103 141 Devices for supplying corn, etc., to poultry.

15 992 Egg-tester.

Farm Buildings.

Austria 73 187 Pig-sties.

73 188 Partitions for pig-pens.

Canada 173 218 Apparatus for removing offal from stable floors.

France 482 072 Device for removing warm air from stables, shippous, etc.

Dairying.

Canada 173 319 — 173 355 — 173 401 — 173 543 Milking machines.

173 361 Teat cup.

France 482 281 Combination of a milking machine or the like with a gas engine acting as a pump.

United Kingdom 15 993 Butter conditioner.

United States 1 212 168 Cream separator

1 212 370 Bowl casing drain for cream-separator.

Various.

Austria 73 273 Flower-pot.

United Kingdom 103 027 Flower-pot with domed re-entrant base provided with drainage holes.

AGRICULTURAL INDUSTRIES.

481 — *The Potato Starch Industry in Holland.* — GOOSEW, G., in *In-ven Utroet*, No. 9, pp. 190-192. Amsterdam, February 28, 1917.

The first starch manufactory, established at Foxhol in 1842, was worked by a horse, and could deal with 75 hectolitres of potatoes daily.

After 1860, however, the number of manufacturies began to increase every year. At first the growers could deliver their potatoes at reasonable

prices, but after 1897 all the starch manufactories formed a combine and then bought the potatoes at prices fixed by themselves. The growers, recognising their own interests, then combined together and founded co-operative manufactories.

In 1911, there were 21 private and 13 co-operative manufactories in Holland; in 1916 the former number had decreased to 16 while the latter had increased to 21.

Previous to 1910, it was estimated that the starch manufactories employed 10 million hectolitres of potatoes. In 1915, the area growing commercial potatoes increased to 33 324 hectares producing 10 577 147 kg. of potatoes. The manufactories also utilised other than commercial potatoes, for in 1915, they consumed 12 975 000 hectolitres, of which the co-operative works used 66 per cent. As 1 hectolitre of potatoes yields 11 kg. of starch, the world's production of potato starch should reach about 110 million kg. Part of the starch obtained is converted into dextrin and glucose, either by independent factories or by special installations attached to the starch manufactories.

The dextrin produced is in excess of the needs of the country and a large part is exported to the United Kingdom, Belgium, Canada and Spain.

The glucose industry, first established in Holland in 1875, has developed very widely: in 1910 the production was estimated at 20 million kg., practically the whole of which was utilised in the country.

Since the war, the price of potato starch has continually increased. The poor crop in 1916 forced the Government to fix the amount of potatoes to be converted into starch at 8 200 000 hectolitres. The export of starch has therefore decreased, now only reaching 69 400 000 kg.

182 - **The Commercial Use of Saccharose-Inverting Bacteria for the Manufacture of Lactic Acid, Acetic Acid and Acetone**. — MEZZADROLI, G. (Preliminary note), in *Bollettino dell'Associazione delle Industrie dello Zucchero e dell'Alcool*, Year IX, No. 10, pp. 142-145. Bologna, January, 1917.

From 1913 onwards the writer has been working out, at the "R. Stazione di Bieticoltura" of Rovigo (Royal Beet-growing Station), a series of studies and experiments on the utilisation of beet-juice for directly converting the saccharose into lactic acid, as an accessory manufacture by the side of that of alcohol and sugar. A useful solution of the problem has been found in certain bacteria found in sour milk and beet-juice and which have the property of inverting the saccharose before subjecting it to lactic fermentation. The writer has given the provisory names to the bacteria of *bacilli saccharo-invertenti* and these he subdivides into *bacilli invertenti-lattici* (inverting-lactic bacilli) and *bacilli invertenti-acetici* (inverting-acetic bacteria).

Beet-juice containing about 10 per cent of sugar was sterilised for 30 minutes at 120° C. then inoculated with a pure culture of the "inverting-lactic" bacteria and kept at the optimum growth temperature of 36-38° C. At the beginning of the experiment the liquid was brown; after a few hours it became clear, then amber yellow. It was then strongly

acid, and on being neutralised with sterile sodium carbonate the fermentation continues vigorously until a second, third, or even fourth neutralisation is required. The whole of the sodium carbonate may be added at once, for its presence in excess does not in any way affect the fermentation or the final product, lactic acid. Also, in immediately determining the optical rotation of the must, or liquid for fermentation, the writer observed on the first day a decrease of several degrees in the dextro-rotation, which increases so much that on the fourth day, the rotation was about $+1$; then it became -1 , thus changing sign and becoming laevo-rotatory, and then becoming neutral when almost all the sugar had disappeared. The lactic fermentation of the glucose and of the laevulose resulting from the inversion proceed contemporaneously with the action of the bacterial sucrase.

For each 100 gr. of saccharose fermented there is a yield of 60 to 80 % of lactic acid, 10 to 20 % of acetic acid, 1 to 7 % of alcohol, traces of acetone and higher alcohols. The "inverting-lactic bacteria" have constantly given the same results for the three years 1913 to December 1914 when the last experiment was made. Some races lose their power of inverting saccharose if grown for some generations on solid agar media, or alkaline glucose. Others, on the contrary, retain their fermentative powers, provided they are grown again in the same media as those from which they had previously been selected. The same is true for many races of many wild alcoholic ferments that are brought to carry out some industrial process by Mendelian adaptation.

The "inverting-acetic" bacteria are more active than the preceding ones. The yields of acetic acid are not yet higher than those obtained in practice in acetic fermentation; yet it appears quite probable that it may soon be possible to obtain acetic acid directly from saccharose without passing by the intermediate stage of alcohol. With the information obtained and the yields that can be got, the application of this new process depends on the state of the market prices of acetic acid and acetone.

The writer has obtained, from 100 parts of saccharose, 40 to 50 % of acetic acid, 10 to 20 % of lactic acid, 10 to 20 % of ethyl alcohol, and 1 to 2 % of acetone.

The acetic fermentation proceeds more rapidly than the lactic fermentation, with abundant evolution of carbon dioxide, hydrogen, and small amounts of methane.

The aerobic, macerating bacteria of the *asterosporus* type act similarly. The writer has studied one obtained from Prof. CARBONE of the Bolognese School of Hygiene, and which has given fair amounts of acetone, but not sufficient to warrant commercial application.

In the course of a more thorough study of these bacteria, it is possible that a type could be found giving larger yields of acetone.

Lactic acid can be changed by oxidation with hydrogen peroxide to acetic acid, and from the latter acetone can be obtained in commercial quantities more easily and at less cost.

Thus, by means of sugar inverting bacteria one can manufacture lactic acid, acetic acid and acetone. The writer also studied a butyric fermentation proceeding from saccharose and giving higher yields than previously obtained in practice and also equal to the calculated theoretical yields (the work proceeding without any reduction and thus without loss of carbohydrates). Unfortunately, the cultures died and it was not possible to obtain fresh ones.

The author proposes to describe in detail in subsequent notes, the biochemical properties and biological behaviour of sugar-inverting bacteria.

483 - **The "Omega" Milking Machine and Its Influence on the Yield and Quantity of the Milk: Experiments at the Federal Dairying Station of Liebefeld (Berne), Switzerland.** — KÄPPEL, J., The economic importance of mechanical milking and its influence on the milk yield. — in *Annuaire agricole de la Suisse*. Year XVII, Part 1, pp. 167-183, tables and figures. Berne, 1916.

I. — On the proposition of Dr J. KÄPPEL, in charge of investigations on milking machines in Switzerland, it was decided to instal an "Omega" milking machine (1) by OTT BROTHERS, Flen, Sweden in the Liefefeld Dairy Station near Berne in order to investigate mechanical milking.

The installation for 20 cows, including 3 milking machines worked by the ordinary stockmen, can be run by an experienced person assuming that milking does not need to be finished by hand. Without the engine and assuming conditions not requiring long piping in the shippon, an installation would cost approximately:

for 15 to 20 cows, with 2 milking machines, £. 72.

for 40 to 50 cows, with 4 milking machines, £. 100.

These prices are much increased at present.

The experiments were carried out on 12 cows, some having been eliminated for low milk production.

The cows were machine milked successfully the first time and afterwards they were no more disturbed than by hand milking.

The first test was made in order to ascertain the influence of the milking machine on the milk yield. The machine was at first finished by hand stripping and finally operated alone. The writer found a certain decrease in the milk yield when the hand milking was omitted, as the following figures show:

Milk obtained		
Machine milking finished by hand	2167 lbs in 1159	minutes, i. e. 1.87 lbs per minute.
Machine milking alone.	3278 lbs in 1771.5	minutes, i. e. 1.85 lbs per minute.
Decrease: 0.02 lbs per minute.		
Hand milking (for comparison). . .	4092 lbs in 1504.5	minutes*, i. e. 1.39 lbs per minute.

* Including preparing the teats and complete hand milking.

(1) See B., 1915, No. 213 and B., 1916, No. 1022.

(Ed.).

During these experiments, it was found that the milk obtained by mechanical milking was not quite satisfactory from the point of view of purity and cheese making. The makers then so altered the installation as to eliminate this drawback.

From a later series of experiments (hand milking, machine milking finished by hand — machine milking alone), the results of which are given in detail in tables, it appears that mechanical milking, if not finished by hand, causes a decrease in the milk yield, while when finished by hand, the results are similar to those of hand milking.

According to observations by the writer and a veterinary surgeon mechanical milking had no harmful influence on the udder during the seven months of the experiment.

As incomplete milking may cause a decreased milk yield, hand milking following the use of the machine appears indispensable for all the milking machines at present in use. This fact somewhat detracts from the economy in labour considered as the principal advantage of these machines.

From the tests, the writer has drawn the following conclusions:

1) The "Omega" milking machine works well; it is comparable, if not superior, to the other models.

2) Most cows are easily accustomed to the machine, but all do not allow of complete milking, so that subsequent hand milking can not be neglected without causing a loss of milk.

4) The milking machine has no injurious action on the udder.

5) Carefully conducted hand milking is preferable to the best of milking machines. On the other hand, a good milking machine working well is preferable to a poor milker.

6) For the present, it is not considered advisable to introduce milking-machines into Switzerland. For small farms with 12 to 15 cows, their use does not allow of sufficient economy in labour to warrant the expense of installation and working. Even large farms should prefer hand to machine milking as long as good milkers can be found. In general, practical men prefer hand to machine milking.

484. **The Simplified Molecular Constant and Its Application to Milk from the Yonne District, France.** — SIKOT, M. and JOURNET, G., in *Annales des Falsifications et des Fraudes*, Nos. 97-98, pp. 425-445. Paris, November-December, 1916.

The simplified constant of molecular concentration established by MM. MATHIEU and FERRÉ (1), seems to the writers, confronted with their own results, to be of great value in researches on the watering of milk.

Numerous investigations have shown that milk serum, secreted under normal conditions, has certain physical constants such as electrical resistance, refractive index, freezing point of crystalloid solutions.

As these constants are not easy to apply practically, MM. MATHIEU and FERRÉ, using as basis the fact, proved by M. PORCHER in 1906, that sodium chloride regulates the osmotic pressure of milk serum and that its

(1) See *Annales des Falsifications et des Fraudes*, No. 63, pp. 12-21 Paris, January 1914.

variation is the inverse of that of lactose, which is the most important crystalloid in the serum, have applied the quick and easy estimation of the lactose and chlorides to the investigation of the watering of milk. Having concluded from their observations that "the molecular concentration of lactose + chloride should vary only very slightly", MM. MATHIEU and FERRÉ call the sum of the two the "simplified constant of molecular concentration"; the figure for the chlorides is represented by its isotonic equivalent in lactose; deduced from the molecular depression given by RAOULT, the isotonic equivalent of sodium chloride, expressed as hydrated lactose, is 11.9.

The constant per litre of milk would be: $a + (b \text{ } 11.9)$, where a equals the quantity of lactose, b the quantity of chlorides expressed as sodium chloride.

This constant is brought up to the litre of serum by considered the volume of the insoluble, and it finally gives the true molecular constant expressed by CMS.

For 224 samples of milk out of 239 samples examined by MM. MATHIEU and FERRÉ the CMS varied from 74 to 79; from this it is concluded that "in 94 % of the samples it was possible to indicate, without fear of error, milk having less than 74 CMS as watered, and in addition, no milk however rich, watered to 8 %, would have escaped the test". In pure milk coming direct from the shippin, the constant was never below 74: "a 5 % watering would be detected in most cases".

Finally, MM. MATHIEU and FERRÉ conclude that "once the minimum CMS constant has been fixed for a certain product, if the Laboratories for the Repression of Fraud adopt the method, they can ascertain the fact of watering, without any control samples as precisely as with the freezing-joint method of M. STOECKLIN".

Dr. G. W. MONNIER - WILLIAMS has studied the CMS in various samples: the average value for 44 milks was 74.4, the maximum being 78.1 and the minimum 70.9; out of the 44 samples, 17 had a CMS lower than 74, and he concluded that "the results obtained by MATHIEU and FERRÉ are not so good a constant as the solids not fat or the lactose".

To test the value of the MATHIEU and FERRÉ method, the writers carried on observations for over a year on the milk in the Yonne district. The results obtained by them for the CMS are shown as follows:

	Minimum	Maximum	Average
Pure milks	70.1	80.7	73.5
Normal milks from the Service for the Repression of Fraud	70.0	78.3	74.2
General results	70.0	80.7	73.9

From the general results, it appears that about 30 % of the samples, i. e. less than $\frac{1}{3}$, have their constant less than the general average of 73.9. The majority have a constant of over 74. As regards differences of breed, feeding, district, the results are not sufficiently numerous to enable their in-

fluence on the CMS to be judged, but it should be noticed that the average CMS numbers for the different regions are :

Loiret department	74.5
Nièvre department	73.7
Yonne department	73.8

For the milk of 14 "Parthenaise-maraichines" cows from the Vendée the average CMS number was 74.1.

The differences found by Dr MONNIER-WILLIAMS are comparable to those found by the writers, the mean being 74.4.

The averages found by MM. MATHIEU and FERRÉ are not much different from those of the writers, who are of the opinion that so far, for mixed milks, the differences of climate, breed and food do not cause wide variations of the CMS.

It should be noted that individuality is of great importance in determining the constants.

As regards the seasons, the authors found :

	Average CMS
Milks in cold season	74.0
Milks in warm seasons	73.9

The averages are, therefore, the same for the two seasons. No matter what influences may come into play, the CMS does not go below 70; and any milk giving a figure below this should be considered as watered.

As regards doubtful milks examined by the writers, 40 samples were divided, with the help of the CMS, into : 19 watered, 19 natural, 2 doubtful ; that is, in 95 cases out of 100, suspicions would be made certitudes in one way or another. The conclusions arrived at are as follows :

The simplified constant of molecular concentration of milk is not a constant in the absolute sense of the word ; it does not allow, any more than the solids not-fat, of detecting *all* watered milks, as the maxima and minima are too far apart (70-80). However, it is better than the solids not-fat because : 1) the difference between maxima and minima is less ; 2) there is a clear minimum ; 3) this minimum is close to the average.

The CMS, determined along with other constants, will enable the expert to detect watering when the CMS is less than 70, even for individual milks. Slight watering of unusually rich milks can, however, pass unnoticed. Yet the CMS has not the value of the freezing point ; this without doubt remains the best test for watering, but it is very difficult to carry out.

485 - The Contamination of Milk by Animal Faeces: Experiments in Italy. — DALLA TORRE, C., in *Annuario della R. Stazione Sperimentale di Casificio di Lodi*. Year 1915 pp. 15-19. Lodi 1916.

Amongst the bacteria in faeces, the majority of which are quite harmless organisms occurring in water, air and on forage, the *coli-aerogenes*

bacteria constitute a group of organisms capable of causing serious harm to the cheese-making industry and of rendering milk undrinkable and even dangerous to the consumer.

The researches carried out by the writer at the Royal Cheese-making Station at Lodi in order to find the number of *coli-aerogenes* bacteria contained in the faeces of cows and pigs, have given the following results :

	In 1 gram of	
	cow dung	pig dung
Number of microorganisms	500 million	3400 million
Number of bacteria of the	1 million	8 million
<i>coli-aerogenes</i> group.	1.5 million*	4 million*

* Counts made at another time.

These results show that there are a large number of organisms in dung, more being present in that of the pig than in that of the cow, and that there is a fair proportion of *coli-aerogenes* bacteria, again present in greater numbers in pig-dung than in that of the cow.

In order to show how a small amount of excrement can produce, in milk and in a short time, a large number of gas-producing *coli-aerogenes* bacteria, the following experiment was carried out : a small amount of excrement was introduced into a litre of sterilised milk with a platinum needle ; after well shaking, it was allowed to stand in the laboratory from 12 to 24 hours : then, after a short time the bacterial count was made, giving results as follows :

Number of coli-aerogenes bacteria found :

	In 1 cc. of milk	equal to number in 1 litre of milk
After 12 hours	2 million	2 milliard
After 24 hours	11 million	11 milliard

This experiment shows the danger that may result to the cheese-making industry from the contamination of milk by animal excrement and it confirms the rules of cleanliness so often advised and so little obeyed.

86. **A Case of Ropy Milk Due to *Bacterium aerogenes*.** — DALLA TORRE, G., in *Annuario della R. Stazione Sperimentale di Casificio di Lodi*, Year 1915, pp. 28-30. Lodi, 1916.

A serious case of infection due to *Bacterium aerogenes* was observed in 915, in the neighbourhood of Piacenza, Italy, in a farm where the milk of the whole herd was perfectly normal after milking, but which, after 10 or 12 hours, became ropy, finally becoming a mucilaginous mass.

The cows were all examined by a veterinary surgeon and were found to be healthy. After the close examination of the shippens, wells, barns, hay-lofts, 7 specimens were taken for bacterial examination, for which lactose agar was used both for plate and slant cultures ; gelatine serum being also used.

The following samples were examined :

Number

- 50 I Ropy morning's milk taken in cans ;
 50 II Milk of cow No. 2, isolated away from the shippon, but given the ordinary farm fodder ;
 50 III Milk from cow No. 4, isolated away from the shippon, but given the ordinary farm fodder ;
 50 IV Well water ;
 50 V Water from the drinking-trough ;
 50 VI Half-dry fodder ;
 50 VII Green fodder.

The day after, there were seen to be little white colonies on the lactose agar, which drew out into short threads on touching with a platinum needle. Microscopic examination showed the presence of a broad, short, rod shaped bacterium, non-motile and easily stained. From the characters of this bacterium it was identified with certainty as *Bacterium aerogenes*.

The approximate numbers of bacteria contained in 1 cc. of the specimens examined were :

No. 50 I	67 000 000	No. 50 V	10 000 000
No. 50 II	6 000 000	No. 50 VI	1 000 000
No. 50 III	7 000 000	No. 50 VII	3 000 000
No. 50 IV	800 000		

On inoculating the bacterium into sterilised milk, the milk became ropy in 10 hours.

The 2 cows isolated from the shippon, after a sample had been taken then placed in an uninfected place, gave, owing to the conditions of cleanliness, milk quite normal and in no way ropy. It thus seemed most probable that the trouble was due to a general infection of the water, shippon and hay lofts by *Bacterium aerogenes*.

In such a difficult case it was only possible to advise a thorough disinfection of all the utensils and cans used, as well as of the drinking trough hay lofts, and especially the shippon, while emphasising the need for strict cleanliness in the dairymen, cows, buildings and utensils.

487 - **Egyptian Milk and Butter.** — GEORGIADIS, in *Annales des Falsifications et des Fraudes* Nos. 99-100, pp. 29-33, Paris, January to February, 1917.

MILKS. — In order to suppress the adulteration of milk, the Egyptian Minister for the Interior asked the Department of Public Health to determine the standard amount of fat and solids not fat which should be present. Taking as a basis the results of analyses made in the Municipal Laboratory of Alexandria, the Public Health Department proposed to fix the following limits :

1) <i>Buffalo's Milk</i> ("Camousse") :			
Fat	5.0 %	Solids not fat	8.5 %
2) <i>Cow's Milk</i> :			
Fat	4.0 %	Solids not fat	8.5 %

In the towns of Egypt not only cow's milk, but more especially buffalo's milk is drunk. The milk of goats, sheep, asses or camels is little used in the towns. The custom of milking the cow before the customer's door, which was once very general, is gradually dying out in Cairo.

It is very difficult to fix a very definite composition for cow and buffalo milk in Egypt as there is a great discrepancy between the averages obtained by different chemists. As a result of investigations made there, the Municipal Laboratory of Alexandria determined to fix limits of 8.5 and 1.0 % for solids not fat. On the other hand PAPÉL and HOGAN obtained the following results from the analysis of 61 samples of buffalo milk:

	Minimum	Maximum	Average
Solids not fat	6.05 %	9.75 %	7.95 %
Fat	6.4 %	10.4 %	9.95 %

A series of analyses of buffalo milk gave the following results:

	Minimum	Maximum	Average
Fat	5.1 %	9.5 %	7.3 %
Solids not fat	8.3 %	10.5 %	9.4 %

There is a great difference in the milk yield of the cow and the buffalo.

	Minimum	Maximum	Average
Cow	1 oke (1)	3 okes	2 okes
Buffalo	1 oke	5 okes	3 okes

BUTTER: Fresh butter is very rare in Egypt and few local farms make it; usually it is imported from Europe or Australia. Melted butter, *Samma*, is generally used for cooking. The Arabs use a fat containing a small amount of serum and casein which they call *zibda*. Egyptian butter is sometimes made from cow's milk but more often from buffalo milk (*gawusse*). Butter made from the milk of sheep and goats is also used. This is generally imported from Syria and rarely made locally.

As with milk, it is difficult to fix limits which will prevent the adulteration of butter. The writer proposes that dealers should be obliged to state the animal from whose milk the butter is made.

The characteristics of the fat of buffalo milk are: — A high REICHERT-DESSL number, 32 to 35, or even 38; a refractive index (ZEISS refractometer) of from 41 to 43; a POLENSKE number of from 1.3 to 3.7 and a saponification index between 217 and 235.

88 — "*Grana*" Cheese Attacked by *Penicillium Roqueforti* at the Cheese Making Station at Lodi, Italy. — DALLA TORRE, G. in the *Annuario della R. Stazione Sperimentale di Caseificio di Lodi*, Year 1915, pp. 20-22. Lodi, 1916.

It is well known that certain species of *Penicillium* cause the characteristic odour, taste, and colour of various types of cheese. Thus *Penicillium Roqueforti* (var. of *P. glaucum*) is peculiar to the French Roque-

(1) 1 oke = 1.345 kg.

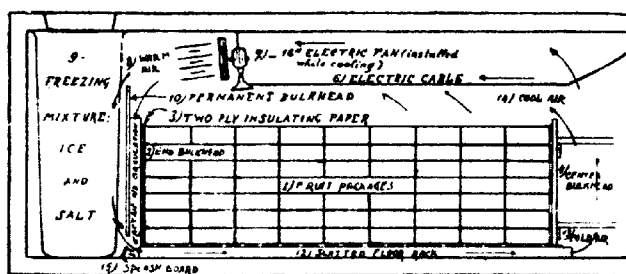
fort cheese (ewes' milk) and also occurs in the Italian Gorgonzola and the English Stilton. It is also sometimes found in butter kept for a long time in dirty places, which then has the odour of the above cheeses. It can also, together with other moulds, damage certain cheeses with hard or soft rinds, the latter particularly when new and not yet hardened. This has been observed at the Royal Cheese-Making Station at Lodi where some pieces of "grana" cheese (parmesan) had a surface mould of a greenish white colour, which at first seemed harmless but after a few days attacked the rind and penetrated deeply, being difficult to remove. The cause was found to be *Penicillium Roquesfortii*.

This occurrence, which had not been seen previously at Lodi, was probably due to the wind carrying spores of *Penicillium* from the Gorgonzola store-room, and thus infecting the "grana" cheese, or again, more probably, it was due to infection from utensils or the persons or clothes of the workers.

If the infection had been neglected it could have caused serious damage, but owing to the conditions of cleanliness, it was at once eradicated.

489 - The Use of Brine Tank Refrigerator Cars for Fruit Shipment. --- Don Canada, Department of Agriculture, The Agricultural Gazette of Canada, Vol. 4, No. 2, pp. 110-114, Ottawa, February, 1917.

At the cold storage warehouse of the Dairy and Cold Storage Branch of the Department of Agriculture at Grimsby, Ontario, experiments were



carried out to determine the value of various methods of precooling, packing and shipping tender fruits over long distances. In 1916 the use of the brine tank refrigerator car was carefully studied, and the car was found to be admirable for shipping such perishable goods as poultry, meats, dairy products and fruits.

During the transit of dressed meat or poultry it was found possible, even in hot weather, to maintain freezing temperature in the car by the continual addition of rock salt to the ice. During the shipment of fruit the use of salt was omitted, because of the supposed danger of freezing, the ice being

put in the tanks in block form. This was found to be a mistake. When the ice is placed in the tanks in large blocks, it only melts when the heat has been transmitted through the iron walls, and rarely descends below 50° F. In order to obtain low temperatures the ice must melt, and to reach this end, salt must be freely added during the whole journey. In the first brine tank trial of shipment between Grimsby and Winnipeg, the fruit was precooled to 43° F. and 500 lbs. of rock salt were added to the ice. During the trip the temperature rose to 53° and the shipment resulted in a heavy loss. A further shipment was made between Grimsby and Brandon. In this case the car was precooled to 39° and 5 % salt added in re-icing. The fruit arrived in splendid condition.

The appended diagram shows a longitudinal section of the refrigerating car. End bulkheads are installed which allowed a 4 inch space between the fruit and the permanent bulkheads in the car. This permitted a free circulation of air to pass from about the cold brine tanks underneath the slatted floors to the centre of the car to replace the warm air.

This method of refrigeration gives excellent results. Neither freezing nor injury from low temperatures occur with the use of 5 % salt with crushed ice, when slatted floor racks are used so as to assure the free circulation of the cold air.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

490 - Effect of the Sirocco upon Tunisian Vineyards, in July 1916. — *Bulletin de la Direction générale de l'Agriculture, du Commerce et de la Colonisation de la Régence de Tunisie*, 20th. Year, No. 89, pp. 199-208, Tunis, 1916.

Up till the 1st. of July, 1916, the Tunisian vineyards were in splendid condition and promised an abundant crop, unfortunately, during the first fortnight of that month there was a sudden rise of temperature and violent gusts of sirocco which caused very serious damage.

A hasty enquiry from a certain number of growers elicited the fact that the damage was very irregularly distributed and that various factors were capable of increasing or diminishing the harmful action of the sirocco. It therefore seemed a useful plan to collect as large a number of observations as possible in order to obtain some future information with regard to means capable of being applied in the future, in order to reduce the damage from sirocco.

Question papers were circulated by the Department of Agriculture among a large number of vine growers: the present paper gives an analysis of the answers received.

It seems to result that the damage is due less to the high temperature than to the insufficient supply of soil moisture in relation to the intense evaporation caused by the warm wind; some vineyards, indeed, have resisted remarkably well in spite of their having been exposed to the most violent sirocco.

A certain number of natural factors tend to increase the amount of damage: compactness, small depth, white colour of soil, southern exposure. The only thing that can be done is to bear in mind these factors when selecting future sites for plantations.

The observations communicated by the vine growers all agree with regard to the greater resistance of certain stocks.

1. — *Red stocks*. "Alicante". — Resisted very well everywhere in many vineyards remained absolutely unharmed; damage from 0 to

0%. "Cinsaut" — Resistance similar to that of "Alicante"; often unharmed; damage from 0 to 15%.

"Terret-Bouret" and "Aspiran" — Suffered little.

"Mourvèdre". — Resistance good, somewhat less uniform, however, than for the preceding stocks; damage 5 to 30%.

"Picpoul". — Resistance fair.

"Carignan". — Resistance fair, varying greatly according to the vineyard; damage from 0 to 15%.

"Petit Bouchet". — Habitually regarded as resistant, doubtless on account of its earliness. It suffered a great deal in 1916 when the sirocco came earlier; damage sometimes reaches 60%.

"Alicante-Bouchet". — Suffered badly in almost all the vineyards.

"Aramon" and "Morastel". — Suffered worst, the damage going sometimes as far as the complete scorching of the grapes.

II. — *White stocks*. — In general, suffered more than the red stocks; at one has been recorded as having resisted well.

"Clairette" and Chasselas" have been among the least injured, though, in some vineyards, they lost 50% of their bunches. "Muscats" "Beldi", "Ugni", "Pedro Ximenes", "Colombar" suffered very badly; large number of plants have had their bunches completely dried up.

There are some factors which are in the control of the grower. All factors causing the exhaustion of the soil in moisture or nutritive elements (plantations too crowded, adventitious plants, presence of living shade plants) increase the injurious action of the sirocco. On the other hand, all operations which favour the conservation of soil moisture and soil fertility (hoeing, manuring, irrigation) and those which tend to reduce evaporation (particularly the removal of shoots) are of a nature to diminish the damage done by sirocco.

The importance of the damage caused in Tunisian vineyards by the sirocco of July 1916, is undoubtedly largely due to the long spring drought which had impoverished the soil in water. Such a combination of circumstances, without being exceptional in Tunis, rarely occurs with such intensity. It does not seem too rash to believe that the improvement of cultural operations is capable, in normal years, of reducing to an insignificant matter, the danger which the sirocco threatens to the grape harvest of the country.

11. **Toxic Chlorosis of Maize. The Internal Secretion and Natural Resistance of Higher Plants to Poisons and to Parasitic Diseases** (1). — MAZÉ, P., in *Comptes rendus des séances de la Société de Biologie*, Vol. LXXIX, No. 19, pp. 1059-1066. Paris, 1916.

The writer has been researching for some time past, upon experimentally produced chlorosis of *Zea Mays*.

The disease, unlike the chlorosis observed in plants deprived of sulphur and iron, is due to a more or less secondary intoxication of the plant. Drops of the cell sap and exudate of normal leaves placed upon sick leaves restore the green colour to these latter.

(1) See P. February 1915, No 226.

(Ed.).

This curious curative property of the cell sap may momentarily disappear under the influence of atmospheric conditions unfavourable to growth. The elaboration of an active sap thus appears as the result of protoplasmic activity which may amount to an actual internal secretion. The rôle of this secretion is to ensure the resistance of the plant to accidental poison and parasitic diseases.

The writer gives an account of the facts on which these statements rest.

I. — *The addition of lead to the nutritive solution and also the addition of methyl alcohol produce toxic chlorosis of maize.* — The spring water employed by the writer for the last 20 years for preparing nutritive solutions suddenly became useless for the purpose owing to the occurrence of lead which produced toxic chlorosis.

Lead, in the three following forms and in the following proportion was introduced into a complete mineral medium A, prepared with distilled water :

1) Lead shot	10 gr. per flask of culture medium
2) Litharge	2 gr. or 5 gr.
3) Sub-acetate of lead	4 cg. or 8 cg.

To the 3 media so obtained two control media were added, the first composed of the medium A, the second of the ordinary mineral medium B prepared with spring water and pure commercial salts.

These 2 control solutions contain :

	Solution A	Solution B
Sodium nitrate	0.5 gr	0.5 gr
Monopotassic phosphate	0.25 "	0.25 "
Bipotassic phosphate	0.25 "	0.25 "
Magnesium sulphate	0.1 "	0.1 "
Iron sulphate	0.02 "	0.02 "
Manganese chloride	0.01 "	0.01 "
Zinc chloride	0.01 "	0.01 "
Potassium silicate	0.01 "	0.01 "
Aluminium sulphate	0.01 "	0.00 "
Sodium borate	0.004 "	0.00 "
Sodium fluoride	0.002 "	0.00 "
Potassium iodide	0.002 "	0.00 "
Calcium carbonate	1 "	1 "
Water	distilled 1000	spring 1000

Solution A is the complete medium (the composition of which was experimentally determined by the writer) which satisfies the needs of maize in mineral elements and enables it to develop fully.

The 5 solutions described above are put into 2-litre bottles and sterilised at 120° C. The 10 to 12 day old maize seedlings are introduced with the necessary precautions to prevent bacterial contamination.

The writer has observed that the plants which grew in the *A* solution with addition of litharge became chlorotic to the same extent as those which grew in the *B* solution (the spring water of which contained lead). The litharge, though insoluble, had a poisonous effect, owing to its state of division.

The lead shot and the sub-acetate were without action in the conditions of the experiment (the quantity of sub-acetate was too feeble).

The methyl alcohol introduced into the *A* solution at the rate of 1 or 2 parts per 1000, by volume, renders the maize chlorotic. The methyl alcohol disappears progressively from the nutritive solution.

II. — *The deprival of zinc, and also of manganese, renders the maize chlorotic and the chlorosis observed in these conditions is of the toxic type.* — The writer had already shown that deprival of manganese rendered the plant chlorotic when it was living in the solution *B* devoid of lead. The deprival of zinc, on the contrary, caused the death of the plant when its dry weight reached 1 to 2 gr.

The writer took up the question anew, making use of solution *B*, but the elimination of the zinc, instead of entailing the rapid death of the plant, engendered toxic chlorosis in the same way as the privation of manganese. This is easy to understand as the medium *B* is already deprived of aluminium, boron, fluorine and iodine.

Manganese and zinc both ward off, by different methods, the same accident of growth. They protect the plant from being poisoned by preventing the production or accumulation of toxic substances in its tissues.

III. — *Experiments on the treatment of toxic chlorosis.* — The "chlororeaction" (a test in which the exudate of normal leaves or their extract after maceration is allowed to act upon chlorotic leaves in order to restore the green colour to their parenchyma) constitutes a very simple method of testing the curative properties of a substance in relation to toxic chlorosis.

Dilute solutions of zinc or manganese salts are without action, even upon the sickness produced by the suppression of one of them in the nutritive solution; similarly the writer has observed that the "chlororeaction" is negative with the complete solution *A*. It has been noticed, however, that toxic chlorosis may be cured by substituting the medium *A* for the solution which engenders it immediately the first symptoms appear. Delay of a few days, however, renders the operation useless.

The exudate and extract of normal leaves are consequently the only remedies so far known against toxic chlorosis. Under their influence the green colour becomes again evident after only 10 hours exposure to the sun on fine spring or summer days. The chlorophyll increases rapidly and the cured cells reacquire their full activity; they elaborate in their turn the active substances which they pass on to the neighbouring cells; the parenchyma gradually regains its green colour, following the direction of the ascending sap, then in an inverse sense as soon as the green band has reached the extremity of the leaf. To sum up: the transfusion of sap neutralises the toxic substances which the chlorosis engenders and

further, renders the cured cells capable in their turn of preventing their formation or of neutralising their effects.

IV. — *Secretion of the active cell sap.* — It is probable that the property which the parenchymatous cells possess of secreting substances preventive of poisoning is not peculiar to maize but is a general faculty which ensures the natural resistance of the living cell to poisons and to parasitic diseases.

Atmospheric conditions exercise an influence upon the internal secretion: fine weather increases it and the excess of the substances so manufactured escapes to the exterior; dull and rainy days diminish the rate of formation and may even cause the preventive substances to disappear completely from the cell sap. The natural resistance of the plant thus varies with the atmospheric conditions.

V. — *Natural resistance of the higher plants to parasitic diseases.* — The writer infers that the rôle of the internal secretions extends as well to the protection of the plant against fungoid diseases. This inference is based upon the influence which the atmospheric conditions exercise upon the course of these diseases.

It is even probable that this protective function is also used against animal parasites.

492 — *Pea-Nut Mosaic.* — MCCLINTOCK, J. A., in *Science*, New Series, Vol. XLV, No. 1150, pp. 47-48, Lancaster, Pa. January 12, 1917.

On September 28, 1915, while looking over a field in which peanuts (*Arachis hypogaea*) had been grown annually for the past six years, the writer observed a plant, of which one shoot bore mottled leaves. A careful inspection of the whole field was made, but no other plant bearing mosaic leaves was found. This made the writer suspect that the trouble was not infectious. It seemed advisable to test this point further, especially since the mosaic plant of *Arachis* was otherwise healthy, except for a few leaf spots produced by *Cercospora personata*.

This mosaic plant was transferred to the greenhouse; before final potting, 2 of the mature pods were removed, and 4 peas taken from them were planted at once in a pot of greenhouse soil.

The 4 resulting plants, together with 2 other seedlings which came up later from peas left on the mosaic plant, have been under observation for the past 5 months. In no case have any signs of mosaic developed. It would thus appear that this mosaic was not carried by the seed.

The original plant continued to grow and produce new leaves at the end of the shoots, but in no case did any but the mosaic shoot produce new leaves affected in the same manner.

To obtain further data of the infectious nature of this mosaic, a pot of 4 peanut plants from a 1914 crop was selected. Two plants were cut with a flamed scalpel to serve as checks. The 2 other plants were treated in the same way, except that into the incisions were inserted bits of macerated mosaic leaflet. These plants have been under observation for the past 5 months, but no signs of mosaic have developed on either the checks or the inoculated individuals.

On October 14, 1915, a pot containing peanut plants from the 1914 seed was taken to the laboratory. By means of Indian ink, circular areas were marked on each leaflet of one plant. Within these circles the tissues were pierced several times with a flamed dissecting needle. This plant served as a check. The second plant in the same pot was treated in a similar way, except that before piercing the leaf tissues, the needle was moistened in the juice from a mosaic leaflet freshly removed from the potted mosaic plant.

Similar checks and inoculations were made on garden peas (*Pisum* spp.) growing in pots, using juice from the mosaic peanut leaflet. On November 13, 1915, the above plants were carefully examined, but neither the checks nor the inoculated plants showed any signs of mosaic on either young or old leaves.

On the same day, in order further to test the infectious nature of this peanut mosaic, one check was prepared by injuring each leaflet of the plant by pinching it between the thumb and finger nail. Eight other plants of the same age and all from the 1914 crops of seed were treated similarly, except that the finger nail was moistened in macerated mosaic leaves before pinching each leaflet to be inoculated.

After more than 3 months after the inoculation, the checks and inoculated plants alike were free from all signs of mosaic. On all the leaves, however, the scars of the finger nail injury were visible.

As the original mosaic plant had matured in the meantime, leaving no fresh leaves to use for inoculation, it seemed advisable to the writer to present this data so that others might be led to record any observation they may make along this line.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

493 - **Bacteria and Fungi in Their Vital Relationships with the Tissues of Plants.** — See No. 415 of this Bulletin

494 - **Observations on the "Oidium" of the Oak.** — NEGER, F. W., in *Naturwissenschaftliche Zeitschrift für Forst- und Landwirtschaft*, 13th. Year, Nos. 11-12, pp. 544-550, fig. 1-2. Stuttgart, 1915.

In a previous paper on the Oidium of the oak, the writer showed how, in 1914, he had several times infected the pedunculate oak with an Oidium which had developed upon a species of *Rubus*. He admitted, however, that his experiments had not been conducted with all the care that could be wished, as it was possible that among the conidia of the Oidium from the *Rubus* and employed for infecting purposes, there might possibly also have been some of those from the Oidium of the oak. It was therefore necessary to repeat the experiments and to eliminate all source of error.

Preliminary examination showed that the Oidium of the *Rubus* had appeared in 1915, in the same localities (at Pastritzleite between Tharandt and Hainsberg) as in 1914, and at a period (end of June) when the Oi-

dium of the oak had not yet appeared. This fact already proved, to a certain extent, the purity of the conidia employed for infection.

The writer infected, by means of the conidia of the *Oidium* of the *Rubus*, some very young oak shoots, hardly developed, which had been kept for a certain time previously in a moist chamber, in order to exclude chance infection. In other cases, he employed as well some oak seedlings developed under a bell-jar, protected from infection. In every case there was subsequent formation of conidia upon the oak.

In order to eliminate the last remaining possibility of error, the writer grew the *Oidium* of the *Rubus* in pure culture upon the young plants of *Rubus* possessing roots, and later used the conidia so obtained for infection tests. It should be remarked, however, that pure cultures of the *Oidium* of the *Rubus* are difficult to obtain, because the species of *Rubus* to be used is difficult to infect. The conidia of the *Oidium* of the *Rubus* obtained in pure culture were placed, on the 13th. June 1915, upon young cut shoots of the pedunculate oak, in a moist chamber; 4 days later a superficial white mycelium was observed at several points; 2 days later still there was a good formation of conidia. Later experiments have given the same result.

The writer, however, has never been able to infect the young leaves of *Rubus* with the conidia of the *Oidium* of the oak; the cause probably lies in the fact that the *Rubus* is very little susceptible to infection. It has been seen above that it is difficult to infect the *Rubus* with the *Oidium* of the *Rubus* itself; logically therefore it is more difficult still to infect the *Rubus* with the *Oidium* of the oak.

In spite of this, the *Oidium* of the *Rubus* should be identical with the *Oidium* of the oak, seeing that it can be transmitted to this latter tree. This is an interesting point as it had been previously supposed that the *Oidium* of the oak is capable of passing as well to members of the Rosaceae. The *Oidium* of the *Rubus*, as well as that of the oak, are said to have appeared in large numbers only during these latter years; this fact, together with the observation that even the fungus of the *Rubus* has only been observed in the conidial form, seem to speak in favour of the identity of the two parasites. Certain observations, however, have shown that these two fungi are quite different. The conidia of the two parasites are distinguished from each other by a constant character: the content of fibrosin bodies. These are found in greater quantity in the *Oidium* of the *Rubus* whilst they are almost completely lacking in the *Oidium* of the oak. The proportion of fibrosin bodies however, is lower for the conidia of the *Rubus* *Oidium* than for those of *Sphaerolheca Castagnei*, which points to the existence of a difference between the *Oidium Ruborum* Rabenhorst — which seems to correspond exactly to the fungus observed by the writer on the *Rubus* — and *Sph. Castagnei*.

How can one explain the apparently contradictory fact that the *Oidium* of the *Rubus* passes to the oak, although it is morphologically different from the *Oidium* of this latter?

The microscopical examination of the conidia which had developed

pon the oak-leaves gave the surprising result that these conidia did not resemble those of the *Oidium* of the oak, but they corresponded exactly with the conidia of *O. Ruborum* (numerous fibrosin bodies, large vacuoles).

This shows that: 1) in favourable conditions it is possible to transmit fungus to a plant-host which is a stranger to it where it can produce spores; 2) artificial infection experiments may possibly in certain cases give false results by leading one to establish identities which in reality do not exist.

The writer proposes continuing the cultivation of *O. Ruborum* upon the oak in order to determine whether the conidia similarly retain their high content of fibrosin bodies.

In the latter part of his paper the writer deals with his observations upon the *Oidium* of the oak. He has followed (spring 1915), in a wood where the oak *Oidium* appeared every year in a disastrous form the opening of the buds and has established that wintering of the *Oidium* in the buds is relatively rare. However, quite a few of these winter forms are sufficient to enable the fungus to retain its vitality from one summer to another; the great faculty for spreading of the *Oidium* is the reason why it appears every year in the form of an epidemic. It is unable to develop to a great extent upon the first shoots, as one might have expected, as there are not yet any conidia and when these latter are present in any quantity, the leaves of the first shoots have become more resistant owing to the greater cutinisation and modification of the cell contents.

The leaves of the second shoots only form a suitable medium for the fungus 2-3 weeks after the development of the second shoots. During this period, that is to say from the middle to the end of July, the development of the *Oidium* epidemic thus gains in intensity; all these infections are due, however, to conidia carried by the wind and not to infection of the buds. As a factor influencing mass infection there may then enter into play the action of the high temperature and of the intense illumination which occur at this period of the year.

95 - **The Internal Secretion and Natural Resistance of Higher Plants to Parasitic Diseases.** — See No. 401 of this Bulletin.

96 - **Role of the Awns in the Resistance of Native Hungarian Wheat to Fungoid Diseases.** — See No. 422 of this Bulletin.

97 - **Acid and Alkaline Spraying Mixtures.** — HÉRON, G., in *Le Progrès agricole et viticole*, 34th. Year, Vol. LXVII, No. 10, pp. 228-230. Montpellier, March 11, 1917.

With reference to a communication by Messrs. VERMOREL and DANTONY to the French Academy of Agriculture on the preparation of copper mixtures for the control of "mildew", whence it appears that acid spraying mixtures are inferior to alkaline mixtures, the writer — President of the Agricultural Syndicate of the Haute-Garonne — states his personal ideas upon this important subject.

Messrs. VERMOREL and DANTONY say that acid or neutral mixtures are carried off by rain and atmospheric agents with extreme rapidity, whilst alkaline mixtures resist much better and remain active for months, giving

up after this time a fair quantity of copper to the water of the atmosphere, whence the conclusion that an alkaline mixture with 1 % sulphate of copper would be superior to a 2 % spray, when it is acid. The writer draws attention to the fact that the acid mixture is a mixture which contains the same quantity of lime per hectolitre, in a copper preparation, as does an alkaline mixture to which is added the quantity of copper necessary to render it acid; from the point of view of its physical composition, therefore, it is just as thick.

The writer states that, if the soluble copper is removed by the rain, it would be the same thing from the point of view of the vine as if no excess of copper had been added, consequently the writer is at a loss to understand why this preparation should cease to be active. He states he has obtained good results from acid preparations.

He questions whether the copper, whose disappearance was remarked by Messrs. VILMORIN and DANTONY had not been partially absorbed by the leaves, thus conferring upon them a certain immunity.

It would be interesting to study this phenomenon and, at the same time, enquire whether it would not be possible to protect vines against fungoid parasites by injecting an immunising solution into the sap.

The writer concludes that: 1) thorough spraying with copper mixtures is more important than ever and that such spraying should extend to all the green portions of the plant; 2) in the present state of our knowledge it would be very dangerous, in a year favourable to "mildew", to reduce the quantity of copper.

498 - **Lime-Sulphur Mixtures in the Control of the "Oidium" of the Vine.** — CADORET ARTHUR, in *Le Progrès agricole et viticole*, 31th. Year, Vol. LXVI, No. 11, pp. 258-259, Montpellier, 1917.

In view of the increase in price of sulphur and of the difficulty of transport, the question of lime-sulphur mixtures is of particular interest in the present circumstances. The writer, who is Director of Agriculture for Cantal, gives the results of his personal researches, carried out chiefly with "Char donnet" (a residue of the manufacture of artificial silks, containing 60% sulphur and 30 % of lime).

The action of lime-sulphur mixtures is absolutely certain, even on the "Carignan" varieties. On this stock, 4 or 5 generous treatments (spread in handfuls) have also got the upper hand of the "Oidium" in circumstances where, formerly, the crop was completely ruined. The writer adds that, if preventive treatment is necessary during the flowering period, it is absolutely indispensable to continue it until the last trace of the fungus has disappeared. On the other hand, it is known that the disease is more difficult to combat the nearer one is to the maturation period. The mixtures should therefore be made up as follows:

End May	—	20th. June	—	sulphur	50 kg.
				— lime or wood ash	50 "
20th. June	—	1st. August	—	sulphur	60 "
				— lime or wood ash	40 "

- 499 - Experiments on the Control of *Stictis Panizzi* ("brusca") and *Cycloconium oleaginum* ("occhio di pavone"), Fungoid Parasites of the Olive Tree, in Italy. — See this *Bulletin*, No. 438.

- 500 - Patents Relating to the Control of Plant Diseases and Pests. — See this *Bulletin*, No. 480.

- 501 - Abnormal Leaf Fall in an Hevea observed in Java (1). — ARENS, P., in *Mededeelingen van het Proefstation Malang*, No. 14, pp. 6-11, Soerabaja, 1916.

After a period of heavy rains there was noticed a sudden shedding of the young leaves of an Hevea, which the previous day showed nothing abnormal. The surrounding trees showed no anomaly. A few similar cases were observed in other plantations situated in the east of Java.

Small black blotches were observed on the petioles and grey-green patches some centimetres in width upon the leaf blades.

The writer showed these blotches to be due to the presence of a fungus of which various fructification forms are known and which has been described as *Gloeosporium Elasticae* by MASSEE and as *Neozimmermannia Elasticae* by KOORDERS.

Pure cultures of the fungus are easy to obtain but the inoculation experiments carried out by the writer did not always give satisfactory results.

It is considered that climatic conditions must be responsible for creating the necessary predisposition of a tree to the disease. In normal conditions in Java the parasite offers no menace.

It is advisable, however, as a precaution, to treat the trees attacked with a spray such as Bordeaux mixture and to collect and burn the diseased leaves.

- 502 - *Phyalospora Theobromae* n. sp., *Stachylidium Theobromae* n. sp. and *Helminthosporium Theobromae* n. sp., Micromycetes Injurious to Cacao under Glass, at Pavia, Italy. — TURCONI MALUSIO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th series, 1st half-year, 1917, Vol. Vol. XXVI, Part I, pp. 75-78, Rome, 1917, *Atti del R. Istituto botanico dell'Università di Pavia*, Series II, Vol. XVII, 8 pp., Plate I, Miln, 1917.

Recently, upon the leaves of a few plants of *Theobroma Cacao* L., cultivated in the glasshouses of the Pavia Botanical Garden, there has been noticed a certain amount of disease of a fungoid nature which, in the present state of our knowledge of the pests of this plant, must be regarded as new.

Upon the infected leaves there are blotches of two distinct forms: some which are marginal and more numerous, are large and of irregular shape; the others, localised in the more central portion of the leaf, are either round or oblong and measure 1 to 3 cm. in diameter. In both cases the blotches upon the upper surface of the leaf are of a light nut-brown or ashy-grey colour and have a reddish brown zone around their margins; upon the lower face of the leaf they are of a light chestnut colour which becomes darker and darker towards the edge.

(1) See B. Dec. 1916, No. 1281.

(Ed.).

Upon these blotches, especially those upon the upper surface of the leaf there subsequently develop little black spots. The number of these is considerable and they are irregularly distributed, forming the perithecia of a *Spheriaceae* which may be classed in the genus *Physalospora*. The writer describes it as new to science under the name of *Phys. Theobromae*.

Upon these same blotches the writer has almost invariably observed a loose, greyish, thin mould usually more abundant upon the upper than upon the lower surface of the leaf. Microscopical examination has shown this mould to be formed of two different conidial forms, micro and macroconidia. The former predominates upon the upper surface, the latter upon the lower.

On the basis of the characters described by the writer these two forms may be referred to the family of the *Dematiaceae* or, more exactly, one is the microconidial form of the genus *Stachylium* and the other the macroconidial form of the genus *Helminthosporium*. They form species new to science and may be called *Stachl. Theobromae* and *Helm. Theobromae* respectively.

It is not yet definitely determined whether the two species represent different imperfect stages or whether they are concomitant forms of the new *Physalospora*, which the writer regards as the original agent of the disease of the leaves described above.

503 - *Ascochyta* sp. the Cause of a Disease of Cabbages, in Germany. — VASTERS, JOSEF, in *Deutsche landwirtschaftliche Presse*, 43rd, Year, No. 35, pp. 308-309, Berlin, 1910.

The writer describes a disease of the leaves of cabbage which appeared during 1915 in Germany, especially in the regions of the Lower Rhine. It attacked the different varieties of cabbage, the leaves of which showed regular round blotches of blackish grey colour. The size of the blotches varied considerably, but the diameter did not as a rule exceed the limits of 0.5 — 1.5 cm.

The blotches are covered with the pycnidia of a fungus. These are black, very small, but still visible to the naked eye. The pycnidia are found especially in very large numbers upon the upper surface of the leaf, while they are practically entirely lacking from the lower surface. The writer has only observed two cases where the pycnidia were more numerous upon the lower than upon the upper surface of the leaf. Apparently therefore, sunlight has an influence upon the appearance of the pycnidia. The centre of the blotch is generally rather higher in relation to the surrounding portions of the leaf and it is occasionally somewhat darker in colour.

Under the microscope, the pycnidia appear spherical but sometimes also a little flattened. Their dimensions vary between 70 and 140 μ — most often between 80 and 100 μ . The spores formed within the pycnidium are colourless and without uniformity of size and shape. The smallest diameter of the spores varied between 2.5 and 3 μ .

It results from the writer's experiments that the fungus belongs to the genus *Ascochyta*. The notes of KIRCHNER on *A. Brassicae* agree partly with the observations of the writer. It should be remarked, however, that

KIRCHNER limited himself to making use of the researches of SACCARDO for the description of this fungus, without undertaking any personal investigation. As, according to SACCARDO, *A. Brassicae* appeared particularly in Portugal and as it has not often been recorded in Germany, the writer recommends other experiments upon this subject.

It is the white heart cabbage which is most often attacked and, according to special experiments made, it appears that the different varieties behave differently. The red cabbage was only slightly attacked. The Savoy cabbage was a little less susceptible to the disease than the white. With the Brussels cabbage, damage was insignificant.

The disease usually appeared late when the plants were already well developed. It only appeared upon the white cabbage when the heads were already closed. It is particularly the outer leaves that are attacked after they fall off. In consequence, the development of the plant is hindered. Another result of the disease is that the cabbage matures so late.

The writer recommends removing the first sick plants that appear from the fields in order to avoid the propagation of spores. This is all the more advisable because the disease appears late, at a time when the cabbage can already be plucked and used in the household.

The practice of a good rotation also gives good results.

24 - *Pestalozzia Briardi* and *Lophionema Chodatii* n. sp., Parasites of the Vine and Scots Pine respectively, in Switzerland. — LENDNER, A., in *Bulletin de la Société botanique de Genève*, 2nd. Series, Vol. VIII, Nos. 1-6 (April-June 1916), pp. 181-185. Geneva, Feb. 26, 1917.

1. — At the base of a vine-shoot sent for examination from Satigny (Canton of Geneva) in 1916, the writer has noticed the occurrence of a constricted portion with a brown colouration; examination with a lens showed a number of little black spots, fairly regularly distributed, and which proved to be the pycnidia of a *Pestalozzia*. Sections cut for the microscope showed that the fungus occupies the exterior portions of the bark, provoking physiological troubles which result in the formation of cicatrization tissue. Though it was not possible to discover any mycelial filaments in the deep portions of the bark, it is evident that the fungus acts from a distance and that it is responsible for the cancerous formations noted.

The *Pestalozzia* studied is identical with the *P. monochaetoides* var. *finis* described by SACCARDO and BRIARD and found by the latter at Troyes (France) upon dead and cut shoots. The writer considers, however, that the fungus in question cannot be regarded as a simple variety, in view of the fact that *P. monochaetoides* type form, has been found by ELLIS at Newfield (North America) on the dry branches of *Spiraea*. The *Pestalozzia* however, seem to be for the most part specific parasites. Further, the *P. monochaetoides* type form possesses conidia smaller than those of the fungus in question. These considerations lead the writer to propose that the fungus discovered by him should be raised to the rank of a definite species, and proposes the name *P. Briardi* Lendner.

This fungus is not frequent. The writer, on visiting the vineyard whence

the sick sample was taken, found no trace of the actual fungus. This no doubt due not only to the fact that this *Pestalozzia* is relatively rare, but also to the fact that the constriction it causes renders the shoot extremely fragile. In the month of June, when the labourer attaches the runners to the props, the runners may even break, if they are sick, at the point attacked and the vine stock is so freed from the fungus and the broken portion of the shoot. If this parasite became more frequent it would probably be very harmful to vines.

In any case, the record of this *Pestalozzia* is interesting as it was previously unknown, not only in the canton Geneva, but also throughout Switzerland.

II. — In the course of an excursion in the Valais, in 1916, Prof. CHODA has observed in the forest of Finge, upon the scales of the cones of *Pinus sylvestris*, small black pustules, visible to the naked eye. Microscopic examination showed them to be the perithecia of a Pyrenomycete which the author describes as a new species, under the name of *Lophionema Chodati*.

505 - Diseases and Pests of the Common Spruce (*Picea excelsa*) in Darnaway Forest, Scotland. — WATSON, H., in *Transactions of the Royal Scottish Arboricultural Soc.*, Vol. XXXI, Part 1, pp. 72-73, Edinburgh 1917.

Trametes radiciperda seems to attack the healthiest and best developed specimens of spruce; this fungus is always present in the plantation.

Chrysomyxa abietis is found in different localities, but seems confined to old mature trees, or stunted suppressed specimens. Alongside of one of these mature infected spruces a small area was planted 2 years ago with 5 different species of *Picea*, but these have as yet shown no susceptibility to the fungus.

Lephodermium macrosporum is somewhat virulent on the needles of a pure spruce crop of 38 years of age. On many of the needles, the conspicuous black perithecia are present; the fungus has been the direct cause of the death of many flourishing trees. During February 1916, numerous perithecia of *Cucurbitaria Piceae* were observed on the buds of a few spruces of about 70 years of age.

Damage to the spruce by insect attack is not found extensively, but *Tortrix tedella* is certainly increasing.

The Scolytidae are represented by *Hylastis palliatus*, *Trypodendron lineatum* and *Cryphalus abietis* which, however, confine their attacks to old or injured trees.

Chermes abietis is very common and attacks both *Picea excelsa* and *P. sitchensis*.

Cones are seldom found without the destructive borings of the larvae of *Tortix strobilella*.

506 - Diseases and Pests of *Pinus ponderosa* in Oregon, U. S. A. — See this *Bull.* No. 454.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

7. The "Gramang" Ant (*Plagiolepis longipes*), from the Point of View of its Economic Importance. — VAN DER GOOT, P. in *Mededeelingen van het Proefstation Midden-Java*, No. 22, fig. Batavia, 1916.

In a previous publication (1) the writer has given an account of the biology of the "gramang" ant (*Plagiolepis longipes* Jerd.) in which light was thrown on several obscure points and new facts revealed, particularly those relating to the propagation of the queens. He also gave an account of the relations existing between the "gramang" ant and the development of the scale insect *Lecanium viride*.

From a study of the scale insects on young coffee plants, to some of which the ants had access and others to which access was impossible, the writer was able to demonstrate the favourable action of the ants upon the development of the scales.

In the presence of the ants the scale insects increase more rapidly and are more vigorous, whilst the mortality is considerably lower than in those colonies to which access on the part of the ants is impossible.

The ants, by probing the scale insects, stimulate an earlier and more abundant secretion. The writer sees in this forced secretion the reason for the earlier development of the scale insects, as the latter are obliged to nourish themselves more abundantly in order to replace the nutriment lost through the secretion. This involves in its turn more active propagation. Further, it has been observed that the colonies of scale insects visited by the ants are only rarely infected by a little parasite (*Cheiloneuromyia javensis*) which, in other conditions, is a frequent parasite of scale insects. This immunity is attributed to the incessant patrolling and activity of the ants.

By working out the conditions of life of this ant, the writer has been able to explain its injurious influence in the Java coffee plantations. It remains to be seen whether other ants have a similar injurious action and the writer has directed his attention to *Dolichoderus bituberculatus* which is almost as widely distributed in Java as the "gramang" ant.

For *Dolichoderus* it has been shown that this ant has practically no influence upon the mortality of *Lecanium viride*. The scale insect, however, increases more rapidly in the presence of the ant as it is less exposed to attacks of parasites. The presence of *Dolichoderus* is thus just as harmful to coffee plantations as that of the "gramang" ant. Both play a similar rôle in the biology of the *Lecanium*.

The influence of the ants is described upon the development of *Pseudococcus crotonis* Green upon the cacao.

This *Pseudococcus* forms a bait for *Dolichoderus* in cacao plantations. As this ant defends the fruit of the cacao against the attacks of *Helopeltis*, the presence of the *Dolichoderus* is much appreciated by the planters.

(1) See B, Nov. 1915, No. 1227

(Ed.)

On the other hand, the presence of the "gramang" ants is injurious to the development of the *Pseudococcus*.

The writer attributes this difference to the fact that the "gramang" ant fails to destroy the principal parasite of the *Pseudococcus*, i.e. the *Diplosis*, whilst *Dolichoderus* pursues it. It is thus to the interest of planters to attract the *Dolichoderus* to their cacao plantations and at the same time to destroy the "gramang" ant.

The discovery of the unfavourable influence of the "gramang" ant both in coffee and cacao plantations has induced the writer to renew his researches upon the best way of destroying it. It follows from these researches that the method described in his previous publication is the best. It consists in digging holes, filling them with the remains of dry leaves and then covering them up with a layer of earth after the ants have built their nests among them. A few holes are made in the upper layer and a little carbon bisulphide allowed to run through. This destroys the ants rapidly and well, and is the cheapest and best method. As the *Dolichoderus* hardly ever mix with the ants there is no fear of their being destroyed. In this way, only the harmful forms are killed, the beneficial forms remaining.

In the concluding chapter the writer describes his observations on *Lecanium viride* and gives a list of its parasites.

Among these latter are included *Chilocorus menlanophthalmus* Muls. whose ravages among the *Lecanium* are, however, not very serious, in view of their relatively slow development, their feeble propagation and limited appetite. Similarly, *Orcus janthinus* Muls. cannot stem an attack of *Lecanium*.

The writer has reared the parasites obtained from infected scales which he had collected from various trees, such as *Gardenia florida*, *Justicia B. tonica*, *Plumeria acutifolia*, *Coffea robusta* and *Citrus Aurantium*.

He obtained 2544 parasites, the species of which were distributed as follows:

<i>Coccophagus bogoriensis</i> Koningsb.	66.4 %
<i>Myiocnema comperi</i> Ashm.	15.7
<i>Aneristus ceroplastae</i> How.	1.9
<i>Coccophagus</i> sp.	8.6
<i>Cheiloneuromyia javensis</i> Glr.	0.5
<i>Cristalithorax latiscapus</i> Glr.	3.8
Undetermined	3.1

On nearly all these parasites, the presence of hyperparasites was observed, which sometimes were capable of destroying as many as 55 % of the insects studied.

However, it results from the writer's researches that the parasites enumerated above have not much importance. For the most part the increase is very slow, moreover, they are not very resistant and attack other scale insects for preference. The ants also hinder their action upon *Lecanium*.

- 508 - **Observations on the Life History of *Agriotes obscurus*, Linn.** — FORD, GEORGE H., in *The Annals of Applied Biology*, Vol. III, Nos. 2 and 3, pp. 97-115. 2 plates. Cambridge, January 1917.

An account of the life history of the Elater *Agriotes obscurus*, the larva of which, in common with related species, is called the "wireworm". Notes on the biology of the larva are given, together with detailed descriptions of both larva and pupa. The Author concludes that the common wireworm in Cheshire, South Lancashire, and North Staffordshire is the larva of *Agriotes obscurus* Linn. It is suggested that the period of time between the egg and pupation is four, and not five years. Characters are given by means of which the larva of *A. obscurus* may be distinguished from the related species *A. lineatus*.

The natural enemies of this insect are discussed; it is concluded that the common mole (*Talpa europaea*) is of great value in checking the pest, and should not be wantonly destroyed unless increasing in too large numbers. The amount of damage caused by a mole is probably very small in comparison with the amount of good it does. With regard to birds, it is suggested that the Plover (*Vanellus vanellus*), which is wholly beneficial, should be stringently protected. As practically all birds except doves and pigeons feed their young on an animal diet, it is obvious that at nesting time they destroy a large number of insects, amongst which wireworms form a fair proportion of the diet. Plovers, Gulls, Rooks, Jackdaws and Starlings are mentioned as being useful in this respect.

The larva pupates in an earthen cell in the ground, down to one foot deep; the pupal period is about three weeks; the imago remains motionless in the pupal cell for roughly two months, after which it comes to the surface, and hibernates under stones, clods, etc., until the next season. These facts may be of importance for dealing with the pest in practice. The paper concludes by giving a bibliographical list of twenty references.

- 509 - **Fungi and Bacteria as a Means of Combating Insects Injurious to the Sugar Cane.** — GROENEWEGE, J., in *Archief voor de Suikerindustrie in Nederlandsch-Indie*, Part 51, pp. 2023-2033. Soerabaja 1916.

Of recent years an attempt has been made to combat the insect pests of the sugar-cane by means of parasitic fungi.

The writer gives an account of the results obtained by GOUGH and ROSE at Trinity, in 1911, and by SPEARE in the Hawaiians in 1912.

In 1914, his attention was drawn to these parasitic fungi by the larvae of *Adoretus compressus*, which were covered by an abundant mycelium. A culture of this fungus showed it to be identical with the *Melarrhizium Anisopliae* described by the writers mentioned.

A pure culture of this fungus was obtained and an attempt made to infect 25 larvae of *Adoretus* by mixing the earth in which the larvae were present with a culture of the fungus upon rice and potato. About a month later two of the larvae were found dead, infected with the fungus.

For another experiment, use was made of the larvae of *Arycides rhinoceros*. After a month 19 of the 24 larvae subjected to this treatment had succumbed to the disease caused by *Melarrhizium*, and two more

were attacked by the same fungus. The experiments were continued in 1915 with larvae of *Holotrichia helleri*, 40 of which were infected by mixing the earth (previously sterilised) in which they occurred, with cultures of *Metarrhizium*. Five weeks later, 11 larvae had succumbed.

Further experiments resulted in the author finding, after three weeks stay in infected earth, 7 dead larvae, and after twelve days, 12 dead larvae all killed by *Metarrhizium*.

The writer considers that these experiments have sufficiently demonstrated the inefficacy of this method for combating injurious insects. The majority of the larvae were only attacked when they were about to pupate. They had already been able, therefore, to do damage, before they were infected.

Another difficulty is that, even when the larvae have reached this stage, they only succumb in part to the disease caused by *Metarrhizium*. Further, thorough treatment with this fungus would entail considerable expense.

The writer mentions later his experiments with *Aspergillus parasiticus* on *Lecanium sacchari* (= *Pseudococcus calceolariae*). When cultures of this fungus were dusted upon the insects the results obtained were nil. A better result was obtained by whitewashing the insects with the cultures. The results in general were so unsatisfactory and the method so costly that the author did not resume his experiments, in view moreover, of the fact that the damage done by these insect to the canes is not considerable.

On studying the larvae of *Adoretus* which succumbed to the disease caused by *Metarrhizium*, the writer found several larvae attacked by another disease of bacterial origin.

A bacillus was isolated 10-15 μ in length and 1.5-2 μ broad, to which was given the name *Bacterium gigas* n. sp. This bacterium forms reddish brown pigmented colonies upon agar-agar, is aerobic and resists mannite, levulose, galactose, maltose, saccharose, raffinose and dextrin in the presence of 0.05 % K_2HPO_4 and 0.1 % NH_4Cl .

On another occasion, from a larva of *Adoretus*, another bacterium, *B. prodigiosum* was isolated.

Experiments have been made on infecting the larvae of *Adoretus* with these 2 bacteria by mixing a pure culture with the earth in which the larvae were buried. The percentage of dead larvae was so small that the writer concluded they were only infected under special conditions. From the results obtained there seems little likelihood of finding a method of fighting insect pests by means of bacterial parasites.

510 - Experiments on the Infection of Insects with the Fungus *Metarrhizium Anisopliae* (1). — RUGGERS, A. A. L., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 25, pp. Batavia, 1916.

The writer's present experiments were suggested by the results obtained by RORER in 1913, at Trinity Island in the control of Rhyncotes

(1) See on this subject *B.* Feb. 1911, N. 650; *B.* Sept. 1914, No. 689; *B.* Oct. 1915, No. 1107; *B.* Dec. 1915, No. 1358; *B.* Dec. 1916, No. 1341; *B.* April 1917, No. 395. (Ed.).

injurious to the sugarcane. For infection purposes spores were employed obtained from a culture on rice mixed with a double quantity of flour.

The *Metarrhizium Anisopliae* (Metschn.) Sôrokin was obtained from Hawaii. The majority of the experiments were made at Buitenzorg (Java), with the larvae of *Leucophilus vorida* and locusts (*Cyrtacanthacris nigricornis*). In one of the experiments the mortality of the locusts owing to infection from *Metarrhizium* reached 80 %. However, on taking into account the results of other experiments, one is led to conclude that such good results are only obtained when the conditions — and particularly the moisture — of the surrounding atmosphere are favourable.

The mortality in the remaining experiments was very slight. As it has been proved that the result of infection, even in a cage where the insects are unable to escape and are in intimate contact with a large number of spores, depends mainly upon the external conditions, the writer concludes that the result of infection in the field depends chiefly upon such conditions. When these conditions are unfavourable to the insects the pest is soon checked without human intervention.

During the rainy season of 1915-1916, the locusts increased enormously in numbers in the centre of the Island of Java (2). In January locusts were found infected with *Metarrhizium*. As a result of the January and February rains, the locusts, died off "en masse" and the pest vanished completely.

The effect of the climatic conditions was so radical that in mid-February the writer was unable to find a single living locust wherewith to continue his researches.

Metarrhizium Anisopliae is found on a quantity of insects in Java. Nevertheless, these insects, which are exposed to infection by it multiply to such an extent as to cause considerable damage. From these observations alone it might be inferred that *Metarrhizium Anisopliae* is a dangerous parasite only in special conditions. The writer's researches have proved this supposition to be well founded.

511. **Partial Sterilisation of the Soil as a means of Freeing it from Injurious Insects and Fungi.** — See p. 676 of this Bulletin.

512. ***Bibio abbreviatus*, a Dipteron Injurious to Celery in Alberta, Canada.** — STRICKLAND, E. H., in *The Agricultural Gazette of Canada*, Vol. 3, No. 7, pp. 600-603, Fig. 1-3. Ottawa 1916.

In the autumn of 1913 and of 1914, a large percentage of the celery plants grown on the Dominion Experiment Station at Lethbridge, Alta, were found to have been damaged extensively by the larvae of the "March Fly" (*Bibio abbreviatus*).

This appears to be an exceptional feeding habit of these larvae, which live for the most part on decaying matter.

As regards the damage to the celery, it was found that a great number of larvae swarmed around the infested plants, so that the whole of the por-

(2) See B. Dec. 1916, No. 1341.

tion below ground might be affected. Towards the base of the plant, damage is most severe, and the excavations are often confluent. Rarely, the larvae burrow deeply into the pulp, thus forming small tunnels. Usually, however, feeding is superficial and apparently not very localised, for small damaged spots occur all over the part of the plant which is below ground, and only at the base, where the plant is most tender, do the larvae appear to feed continuously in one place. The central stems were not injured.

The attacked areas turn brown during the late summer and autumn and are the seat of infection for various fungous diseases and for the larvae of other diptera, such as *Drosophila*, which soon render the plants unfit for the market.

As regards the cause of the damage, the celery beds had been heavily manured and it is on this manure that the larvae live, and in the majority of cases, mature. When, however, the celery is earthed up, to bleach, in August, many of the larvae of the dipteron are brought into contact with the pulpy flesh of the stalks, and apparently prefer it to their normal food.

Since the damage is to a large extent incidental to this method of bleaching celery, it is desirable to avoid it in places where *Bibio* larvae occur in large numbers. Methods of bleaching celery between boards, or prepared paper, have been adopted at the Lethbridge Experiment Station. It was found that where these were materials employed, the celery did not suffer to an appreciable extent, and the results were satisfactory from a horticultural standpoint.

The writer gives all the data at present known regarding the life-history of *Bibio abbreviatus*, and also a morphological description of the larvae and pupae.

513 - *Ceratitis cosyra* and *C. capitata*, Diptera Injurious to Fruit Trees in South Africa. — LOUNDBURY, C. P., in *The Agricultural Journal of South Africa*. Vol. IV, No. 24, pp. 180-187, 1 Coloured Plate. Johannesburg, December 1916.

Although there are a large number of "fruit flies" in South Africa, practically all the damage done by such insects to cultivated fruit trees is the work of *Ceratitis cosyra* and *C. capitata*.

The first of these diptera is common in Natal, and the second in the Cape Province. Both species occur in the Transvaal, but *C. capitata* is usually much the more abundant.

After giving an account of the life-history of these parasites, the writer adds that many of the larvae are captured by predaceous insects when they fall to ground in order to pupate in the soil.

Until Mr. C. W. MALLV, now the Cape Province Entomologist, conclusively proved the value of the poison bait remedy (which consists of a light sprinkling of sugar water poisoned with arsenate of lead), eight or nine years ago, the only reliable remedy for fruit flies was to enclose the fruit or the tree as a whole, in netting.

In one year, 1898, 20 000 yards of cheap cotton netting, imported at a cost of about a penny a square yard, were sold to Cape fruit-growers.

The poison bait remedy is now much used in the Cape Province, and though it has to be repeated at short intervals in the Transvaal, owing to

the frequency of summer rains, it is a means by which the fruit fly pest can be suppressed even in gardens surrounded by others where this insect is rampant. It is desirable to begin baiting early in the season, but even if it is done late (in December), it should suffice to protect most of the fruit that ripens in February, or later.

514 - **Insects Injurious to the Spruce in Darnaway Forest, Scotland.** -- See this *Bulletin*, No. 505.

515 - ***Hylastes cunicularius*, Er. and its Relation to the Forest in Scotland.** -- MUNRO, JAMES, W. in *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXXI, Part 1, pp. 25-30. 1 Pl. Edinburgh, January 1917.

Three species of *Hylastes* attack forest trees in Scotland, *H. ater*, Pk., *H. palliatus*, Gyll. and *H. cunicularius*, Er. The first two have long been known as some of the commonest bark beetles of these forests. *H. cunicularius*, on the other hand, has hitherto been overlooked, probably owing to its close resemblance to *H. ater*.

Of the habits and life-histories of all three species of *Hylastes* our knowledge is scanty and is largely derived from German scientific literature.

Owing to the fact, however, that Scottish forest conditions are markedly different from those prevailing on the Continent, it is essential to study our forest insects afresh from that aspect.

In the present articles, the writer deals with observations made upon *H. cunicularius* under the natural conditions of Scotland.

The material for the comparison of *H. cunicularius* with its congeners is based, partly on specimens taken at Skene (Aberdeenshire) in 1914, and partly on specimens collected on Darnhall Estate (Peeblesshire) during 1915-1916. The materials for the illustration of the life-history and of the injuries caused used to young plantations by *H. cunicularius* were obtained on Darnhall.

The writer describes the adult insect, the egg, larva, brood galleries and the pupa. By his researches it has been established that *H. cunicularius* undoubtedly breeds in Scotland, and it may prove to be more common than is at present supposed. It is essentially a spruce-dweller, breeding below soil level, and it feeds in the roots in which it was reared. If, however, opportunity offers, *H. cunicularius* migrates to young coniferous plantations where it feeds on spruce, Scots pine and larch.

Its life-history and habits are strikingly similar to those of *H. ater*, Pk., but owing to the branching of the roots of its breeding host, the spruce, it is probably a more formidable enemy of young trees planted in old spruce clearings than *H. ater* proves in similar pine clearings.

In the larval stage, *H. cunicularius* is harmless. The adult, on the other hand, injures, or totally destroys, newly-planted conifers of various kinds. Spruce, Scots pine and larch have been found attacked by it.

In the areas under the writer's observation, the loss caused by *H. cunicularius* may be stated as not less than a pound per acre, allowing the cost of planting to be three pounds per acre, a low estimate.

INJURIOUS VERTEBRATES

516 - The Squirrel as an Enemy of Forest Plants and of Birds. — D'ANNE, in *Bulletin de la Ligue française pour la protection des oiseaux*. — Abstracted in the *Revue des eaux et forêts*, 5th. Series, 15th. Year, Vol. IV. No. 1, p. 27, Paris, January 1, 1917.

M. d'Anne has made out a most damaging case against the squirrel. He concludes from his observations that these rodents are great destroyers of birds. He has seen them disturbing birds while building their nests, destroying and knocking down the finished nests, chasing both laying and sitting birds, breaking eggs, killing the young. They attack not only the small *Passeres* but also jays, magpies and hawks (these of more combative temperatment, however). They steal the food of pheasants and even visit dove-cots and the poultry yards. In the Somme, where squirrels were unknown or rare, birds were very numerous up to recent years but with the advent of these rodents the birds diminished in number and have now nearly disappeared. If one adds to all these misdeeds the fact that the squirrel attacks both deciduous, especially the poplar, and coniferous trees, one cannot do better than support the recommendation made to the Society of French Agriculturists that the squirrel be regarded as a pest and its destruction encompassed by landowners and farmers upon their lands, at all times, even by the use of guns.

RUGGERI ALFREDO, gerente responsabile.

